LANDSCAPE DISCOURSES OF AMENITY AND RENEWABLE ENERGY DEVELOPMENT IN VITICULTURE REGIONS IN CANADA

by

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ABSTRACT

Shifts from fossil fuels toward renewable energy (RE) are happening worldwide. Although RE contributes to global warming, this shift introduces profound changes to landscapes. Moreover, RE transitions are often happening in rural areas which are also sometimes serving amenity functions and becoming destinations for different types of users. This introduces complexities such as when decision making around RE development. Emerging grape and wine production landscapes serve amenity and production purposes, and this study, divided into two parts, is designed to understand the rural wine amenity experience and perceptions of RE development in such landscapes using case studies of Nova Scotia (NS), Ontario (ON) and British Columbia (BC). Textual and image-based representations of viniculture regions posted on Instagram by vineyard visitors and marketers are used and mixed methods, including content analysis, statistical analysis and visual impact analysis are conducted on the data. The result indicates: 1) that a gap exists in the ecosystem services (ES) framework around terroir, 2) that vineyard experiences are recursively recreated on Instagram, though visitors care as much or more about social relations as they do the terroir that preoccupies marketers; and, 3) the addition of RE infrastructures does not seem to disturb the vineyard experience.

LIST OF ABBREVIATIONS USED

BC – British Columbia

CES – Cultural Ecosystem Service

GIS – Geographic Information System

HCA – Hierarchical Cluster Analysis

NS – Nova Scotia

MCA – Multiple Correspondence Analysis

ON – Ontario

RE – Renewable Energy

VR – Virtual Reality

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CHAPTER 1: INTRODUCTION

1.1. TOURISM AND ENERGY TRANSTIONS IN RURAL AREAS

Renewable Energy (RE) such as solar, wind, biomass, and other forms of clean energy are developing all over the world and are gradually taking the place of fossil fuels. In Canada, for example, electricity generation through clean sources has increased by 18% between 2010 and 2017, and among all RE sources, solar and wind had the highest increases (Natural Resources Canada, 2019). Though contributing to our energy needs and environmental quality, this transition has caused many radical changes in landscapes. Fossil fuel sources are invisible and mostly underground, with often-isolated infrastructures. In contrast, clean energy sources and infrastructures are above the ground, which imposes on landscapes in a more widespread way (Calvert, Greer, & Maddison-MacFadyen, 2019). One of the main reasons for opposition toward RE facilities, including wind energy (Waldo, 2012) and solar panels (R. Xu & Wittkopf, 2015), is their significant visual impact on landscape. Visual impact on landscape is complex, and includes considerations such as "physical appearance, project-place fit, and landscape traditions" (Batel & Devine-Wright, 2021, p 47). A study comparing wind turbines, solar panels, and hydroelectric dams found that the first two RE infrastructures has the most considerable visual impacts on landscapes (Ioannidis & Koutsoyiannis, 2020).

Decision makers typically consider rural areas as the ideal place for setting up RE infrastructures because they possess lower real estate value in comparison with urban areas (Mccarthy, 2015), and have a higher proportion of undeveloped land available (Poggi, Firmino, & Amado, 2018). However, these same rural places have undergone a transition to tourism in many parts of the world because of declines in traditional economies and the mix of natural and cultural values that remain (Šťastná & Vaishar, 2020).

The extension of the vineyard 'cellar door' concept to food and other experiences (once only for sales) and the expansion of viniculture geographically are some of the driving forces behind such transitions to tourism. Therefore, apart from year-round residents, rural areas have recently become a popular destination for a variety of users, including second-home owners and tourists. It, therefore, exemplifies why RE development is complicated in a rural context, in that each group has different purposes for visiting or living there. For instance, amenity rural areas attract second-home owners and tourists mainly because of the aesthetic values of the rural landscape (Bruwer & Lesschaeve, 2012; McNicol & Glorioso, 2014; Pikkemaat, Peters, Boksberger, & Secco, 2009). From the tourists' perspective, for instance, adding transmission lines to Iceland's scenic landscapes is negative (Stefánsson, Sæþórsdóttir, & Hall, 2017). A recent study also showed that residents of Iceland were more supportive of wind farm developments in amenity landscapes than tourists (Sæþórsdóttir & Ólafsdóttir, 2020) as the natural landscape is seen by the latter to be degraded by wind farms (Sæþórsdóttir, Wendt, & Tverijonaite, 2021). The population in amenity tourism areas can also be heterogeneous and sense of community can be low among them (Jennings & Krannich, 2013). Considering all this, challenges can arise when addressing problems, including energy issues, in amenity rural areas.

Much research on rural contexts focuses on the impacts of transition to tourism in rural areas. Some studies investigated positive impacts of this transition (Holland, Smit, & Jones, 2014; M. R. Holmes, 2014; Redmond, 2008; S. Xu, Barbieri, Anderson, Leung, & Rozier-Rich, 2016). In addition, Del Mármol, Celigueta, & Vaccaro (2018) have shown that rural transition to tourism industry in the Alt Urgell District, an area of the Catalan Pyrenees, has brought many social changes in resident lifestyles, altering their daily routines; yet residents can become accustomed to the new changes and adopt new strategies that fit well into the new circumstances in their life (del Mármol, Celigueta, & Vaccaro, 2018). Scholars have identified negative impacts of such transitions, too. For instance, social inequality as a result of such transitions were identified in Washington, USA, which made it difficult for residents without much wealth to afford their life, since the cost of housing had increased with "gentrification" (Sherman, 2018). It is true that the tourism industry has created job opportunities, but they are often low-paid, seasonal, and part-time (Redmond, 2008; Sherman, 2018). Considering all this, studies of this issue are numerous yet identify both positive and negative aspects.

1.2. PROBLEM STATEMENT AND NEED FOR THE STUDY

It has generally been assumed that residents of rural production landscapes will be more comfortable than urban dwellers with exposure to utilitarian infrastructure, whether it be farm silos or oil and gas pump jacks. Research has been voluminous (Petrova, 2016; Rand & Hoen, 2017), but much of it takes a pessimistic view of energy transition in rural landscapes, for meanings of place attachment rather than NIMBYism (Not-In-My-Back-Yard) (Devine-Wright, 2009; Devine-Wright & Howes, 2010; Dmochowska-Dudek & Bednarek-Szczepa, 2018). In addition, different infrastructures represent different cultures, are deeply linked to livelihoods and rural traditions and thus place meanings (Jacquet, 2012; Jefferson, 2018; McLachlan, 2010). Some research has tested local preferences toward RE policies in fossil fuel extraction areas (such as gas production, oil production, and so forth), which has found a relationship between individual demographics and their level of support (Olson-Hazboun, Howe, & Leiserowitz, 2018), and some compare local views on wind farm development and natural gas development in rural areas, concluding that landowners expressed more positive attitudes toward wind farms than natural gas (Jacquet, 2012).

Less explored is the fact that rural areas are also increasingly sites of amenity and lifestyle, where the production landscapes are commodified in ways suitable for second-home owners and weekend day-trippers (Holmes & Argent, 2016; Kaltenborn, Andersen, & Nellemann, 2009; Rye, 2011). This potentially creates overlapping yet conflicting place meanings, which need to be fully recognized for future planning (Nielsen-Pincus, Hall, Ellen, & Wulfhorst, 2010). This has consequences for RE transitions. Emerging grape and wine production landscapes are attractive to regional governments seeking rural renewal, and suitable for RE integration from a technical standpoint (Garcia-Casarejos, Gargallo, & Carroquino, 2018). Yet combining viniculture and RE is potentially socially fraught in terms of conflicting landscape ideals. This context and problem is as-yet unresearched, but critical for rural renewable transformations. Little is known about how vineyard landscapes are experienced and how those experiences might be influenced by energy infrastructure.

1.3. THE RESEARCH QUESTIONS

In this study, we aim to understand the rural wine amenity experience and visual impacts of RE development in such landscapes. To achieve this main objective, we set out two sub-objectives: a) to characterize visitor and market insider portrayals of Canadian wine regions; and, b) to explore the visual saliency of RE facilities and related human sentiments in such settings. To reach our goals, we defined five sub-questions, which are answered in sequential order. Therefore, we organized our thesis chapters based on the questions presented in table 1.

Table 1. Research goals and questions addressed by the following chapters.

Main Goal	Sub-goals	Questions	Methods	Chapter
To identify opportunities and barriers in rural wine amenity landscapes for further RE developments	a) To explore visitor and market insider portrayals of Canadian wine regions	1. How do visitors and market insiders portray wine regions? 2. What are common visual motifs and evidence of CES delivery in wine regions? 3. How is terroir conceptualized in wine regions?	1. Content analysis 2. Multiple correspondence analysis 3. Hierarchical correspondence analysis	2
	b) To explore the visual saliency of RE facilities and related human sentiments in such settings	4. How prominent or salient are RE infrastructures in vineyard visitors' experience both visually and textually? 5. How can vineyard decision makers assess the potential visual impact of RE in their landscape?	1.Content analysis 2. Visual impact assessment with salience maps	3

1.4. THEORETICAL FRAMEWORKS

This study applies several theoretical frameworks to address the above-mentioned research gap (Figure 1). Two of them are "creative destruction" and "creative enhancement" concepts. In the context of rural transitions in amenity-rich areas, these two concepts have been used to describe transformation processes in rural areas (Mitchell, 1998, 2013). The first concept was introduced by Joseph Schumpeter in 1942 to explain "the behavior of capitalist economies"(Mitchell, 2013, p. 375). In 1998, Mitchell used the concept to show how a new landscape structure (such as through tourism) can destroy the preceding one. In the rural context, "creative destruction" is an outcome of functional displacement (Mitchell, 2013). Stated differently, when new functions are introduced to rural areas, they can fully replace the previous functions. This displacement is considered as a form of destruction.

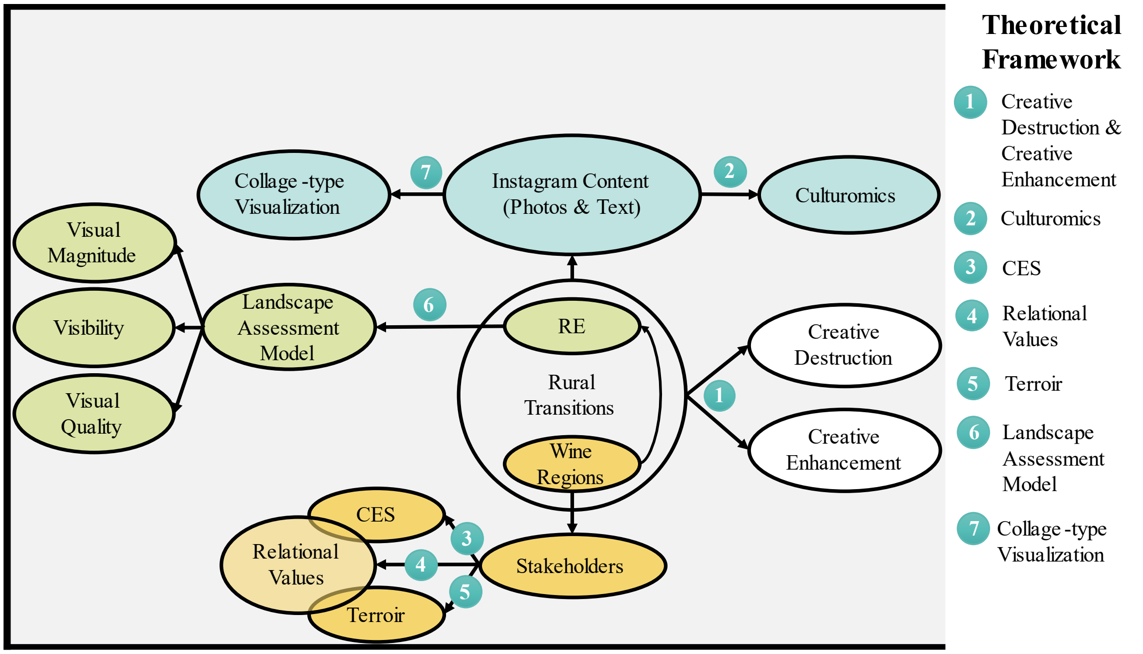

Figure 1. Framework for studying wine regions and rural energy transitions through social media content.

Overarching conceptual framing is based on 1) Mitchell's (2013) concept of creative enhancement and 2) Michel et al.'s (2011) concept of culturomics; 3-5) cultural ecosystem services (CES), relational values and terroir are used to code Instagram-derived data extracted from market insider and visitor accounts (cite); 6) collage methods are used for thematic visualization to balance privacy and copyright concerns (cite); and, 7) vineyard images featuring RE are manipulated and analyzed with the guidance of the landscape assessment model (cite).

By contrast with creative destruction, "creative enhancement" was coined by Clare Mitchell in 2013 to describe the transformation process in rural areas from a "production-based to multi-functional (or consumptive) state"(Mitchell, 2013, p. 385). In other words, in this concept, an innovation function does not force the previous functions out. Instead, the new function co-exists with the previous ones (Mitchell, 2013), without causing destruction. This happens when there is a functional addition (Mitchell, 2013). Mitchell (2013) found three key factors that play a decisive role in the outcome of transition in such amenity rural areas, including consumer demands, internal geography, and stakeholder ideology. Schumpeter might see RE as displacing the tourism which had displaced traditional economies, but Mitchell would see RE added to (and enhancing) tourism and the traditional economies that persist. Our interest here is to establish which is at play, creative destruction or creative enhancement, as RE emerges in wine regions.

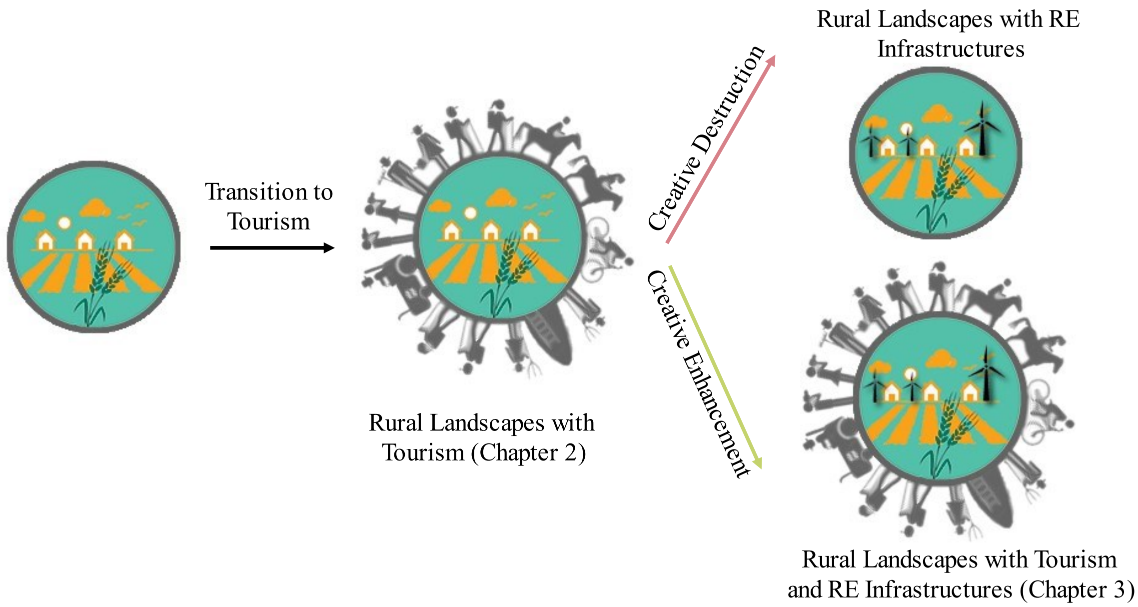

Figure 2. Creative destruction and creative enhancement in the context of rural amenity area

The ecosystem service (ES) framework is defined as tangible and intangible benefits obtianed from ecosytems and contribute to human wellbeing (Millennium Ecosystem Assessment, 2005), among which cultural ecosystem services (CESs) are intangible in nature and therefore hard to identify. The indicators to assess CESs aren't as plentiful as other ESs, such as provisioning, supporting, and regulating services (Feld et al., 2009). Yet, identifying CESs is crucial when it comes to landscape changes that result from development and planning. Increasingly there is an additional category being added which is relational values, defined as "values that individuals hold towards their relationship with nature and with others that are constitutive of an appropriate, meaningful, and good life" (Ishihara, 2018, p. 62). The interactions between people and landscapes shape CESs (Bieling, 2014), and such interactions can be actively observed in wine regions, including between visitors, and vineyards, and between wine producers and vineyards. In addition, in wine regions the interactions between people and landscape is more complex. In such regions, terroir results from interactions between "place, including soil, topography, climate, landscape features and biological diversity, and human factors" (Van Leeuwen & Seguin, 2006, p.1). We used the ES framework in combination with terroir and relational services to identify the values associated with the study areas, which have consequences for further developments.

Another theoretical framework that guides our study is the "landscape assessment model," introduced by Palmer in 2019 and applied to a transmission line project in the US. Based on this framework, used in a few subsequent studies (Dentoni, Grosso, Massacci, & Soddu, 2020), the visual quality of a setting as well as the visibility and visual magnitude of a proposed project are the decisive factors affecting the visual impact of a proposed project in a landscape (Palmer, 2016). A landscape's "sensitivity to changes" is defined as the visual quality of the landscape (Dentoni, Grosso, Massacci, & Soddu, 2020, p 8). Landscape features contribute to its visual quality (Jiang, Kang, & Schroth, 2015); for instance, in rural settings, factors including the wilderness level, man-made elements, color contrast, and presence of water determine landscape visual quality (Arriaza, Cañas-Ortega, Cañas-Madueño, & Ruiz-Aviles, 2004). An object's visibility is determined by examining how easy it is to see from a particular location (Kim, Bone, & Lee, 2020). Viewshed analysis in GIS (Bishop, 2003; Klouček, Lagner, & Šímová, 2015) or photographs (Jean-Christophe, Jens, & Nicolas, 2020; Sherren et al., 2011) have been used by reserchers for visibility analysis. Finally, the distance between observers and object as well as the object's size determine the visual magnitude of the object (Palmer, 2019). This study does not analyze all of these factors and only includes the visual magnitude of the RE infrastructures within a frame, however, it provides a useful framework for us to build upon, which will be elaborated upon in chapter 3.

The last concept we are building on is "Culturomics," which is coined by scholars who leveraged the words and phrases in cultural products to study human culture (Michel et al., 2011; Sherren, Parkins, Smit, Holmlund, & Chen, 2017). They first analyzed the changes in frequency of each word and phrase via searching through digital books, (Ladle et al., 2016; Michel et al., 2011). Three steps have been introduced for using culturomics in research, including finding the digital corpus, selecting data from the digital corpus, and data analysis (Ladle et al., 2016). With proliferation of visual media, some scholars argue that Culturomics should incorporate images along with text to study human culture (Sherren, Smit, Holmlund, Parkins, & Chen, 2016). In our research we build on the concept of "Culturomics" to use pictures and text from social media as a proxy for understanding landscape values. Even though some consider culturomics to involve counting all images and/or words, we sample and code our data to allow for deeper analysis. A recent review of the use of social media in social science research demonstrated that this more "small data" approach is relatively common (Y. Chen, Sherren, Smit, & Lee, 2021). An additional innovation being employed in this thesis is digital collage to illustrate key visual motifs, thus protecting both copyright and privacy within those contributing to the dataset.

1.5. SELECTING STUDY AREAS

We utilize Ontario (ON) and Nova Scotia (NS) wine regions in Chapter 2 as study areas to understand stakeholder experiences in vineyards. They both have significant wine regions—Ontario's quite established by Canadian standards and Nova Scotia's emerging—as well as increasing RE portfolios. In Nova Scotia, electricity from RE has tripled in the last decade, and by 2030, NS is going to generate 80% of its energy from renewable energy (Barron, 2021), and Ontario has the highest number of wind turbines in Canada (Sherren, Parkins, Owen, & Terashima, 2019). Although these two provinces are different in number of RE infrastructures, comparing these regions can give us a meaningful insight about amenity vineyard experiences in a context of RE development. In the associated chapters, we discuss study area selection in more detail.

While both ON and NS have significant wind and solar energy installations (Solar Power Nova Scotia (Complete Guide 2019), 2021; Wind Power, n.d.) that should be visible from vineyards it was difficult to find evidence of this on Instagram.

Our search for vineyard images with RE infrastructure is discussed in more detail later. This resulted in us selecting individual vineyards in ON and British Columbia (BC) that we knew had visible RE for Chapters 3. As with NS and ON, BC has popular wine regions that seasonally attract many tourists each year. In addition, there has been RE development in these wine regions based on their goal of not only reducing GHG emissions but also achieving energy security and diversifying sources of energy (Valentine, 2011).

1.6. METHODS

1.6.1. SECONDARY DATA SOURCES AND DATA COLLECTION

Secondary rather than primary data sets are used in this study, specifically images from social media. Scholars consider this method of data collection a passive approach in comparison to traditional ways such as surveys and interviews in which data are being generated (Heikinheimo et al., 2017). Recent studies have used photo-sharing social media for different purposes, including assessing recreational ecosystem services (Ghermandi, 2018; Hermes et al., 2018), finding advantages and disadvantages of "big data" in conservation science (Heikinheimo et al., 2019), estimating the cultural value of bird biodiversity (Kolstoe & Cameron, 2018), identifying cultural ecosystem services (Retka et al., 2019), and identifying landscape values (Y. Chen, Parkins, & Sherren, 2019), to name but a few. Considering this, scholars indicated that making use of social media in which users share images with captions is efficacious in place-based research. First, people are increasingly sharing their daily life on these platforms (Y. Chen, 2016). Second, the process of taking pictures and selecting among them to share online is reflecting the "quality of the perception" that users have of a certain place (Sottini et al., 2019, p. 5). Third, it is cost-effective for researchers (Y. Chen, Parkins, & Sherren, 2018; Matteucci, 2013) as well as unaffected by COVID-19 restrictions. Moreover, by excluding the role of interviewers, such posts can decrease the bias of 'active 'face-to-face data collection. While it can include otherwise missing voices in landscape changes debates such as youth, it often excludes other voices (Y. Chen et al., 2019). Also, since our phenomena of interest varies by season, we can benefit from data archives available online for any time of the year reducing the limitations of more traditional cross-sectional studies with time for only one engagement with participants. Additionally, this way of data collection is not disturbing for participants as is the case with many active way of collecting data (Heikinheimo et al., 2017). And obviously, there are a large number of data available online which makes the process of data collection convenient for the researcher (Matteucci, 2013). Research such as this is exempt of the oversight of the Human Research Ethics Board, as the data is shared freely online. Research ethics in this domain are emerging from researchers, however (Gelinas et al., 2017).

Instagram was chosen for this research. A recent study has shown that among the photo-sharing platforms Flicker, Twitter, and Instagram, Instagram possesses the highest number of posts (Tenkanen et al., 2017). In addition, Instagram is a social platform in which individuals share their experiences and daily life. Furthermore, this platform allows its users to describe their experiences with meaningful captions and hashtags (Van Zanten, Van Berkel, Meentemeyer, Smith, Tieskens, & Verburga, 2016), which are "key words" by which users can describe their shared photos. Therefore, we used this platform to collect data. Moreover, to find advertisements and to understand how these regions are being commodified, we made use of vineyards' business pages on Instagram as well as individual pages.

However, Instagram is biased in some ways. For instance, not everyone uses social media, and especially younger people tend to dominate Instagram (Instagram, 2019). Regarding this, such a data collection approach cannot fully replace traditional approaches. Rather, it can complement and improve in-person approaches (Y. Chen et al., 2019; Sherren et al., 2017), although there is no approach that is immune to biases.

To collect data from Instagram, hashtag-based search was used in chapter 2 and location-based search was used in chapter 3 (Figure 2), both with the help of Instagram Scraper tool, a command-line tool written in Python (GitHub - Arc298/Instagram-Scraper: Scrapes an Instagram User's Photos and Videos, n.d.-b). The original plan was to use the same data for Chapters 2 and 3, and simply differentiate the experiences between sites and posts with and without RE infrastructure. However, in our original extraction, no photographs featured RE. Several other strategies were used, but eventually we had to identify vineyards that did have RE as case studies for Chapter 3, but still they were very few. These strategies will be elaborated upon in chapters 2 and 3.

To validate the use of Instagram Scraper tool, we conducted statistical analysis of data (figure 3). Our initial hashtag extraction showed a higher number of posts in growing and tourism seasons (between May and October) for both #nswine and #niagarawine (Figures 3), as we would expect, as well as the rising popularity of these hashtags, both suggesting that the Instagram Scraper tool is a promising tool for collecting data for our purposes.

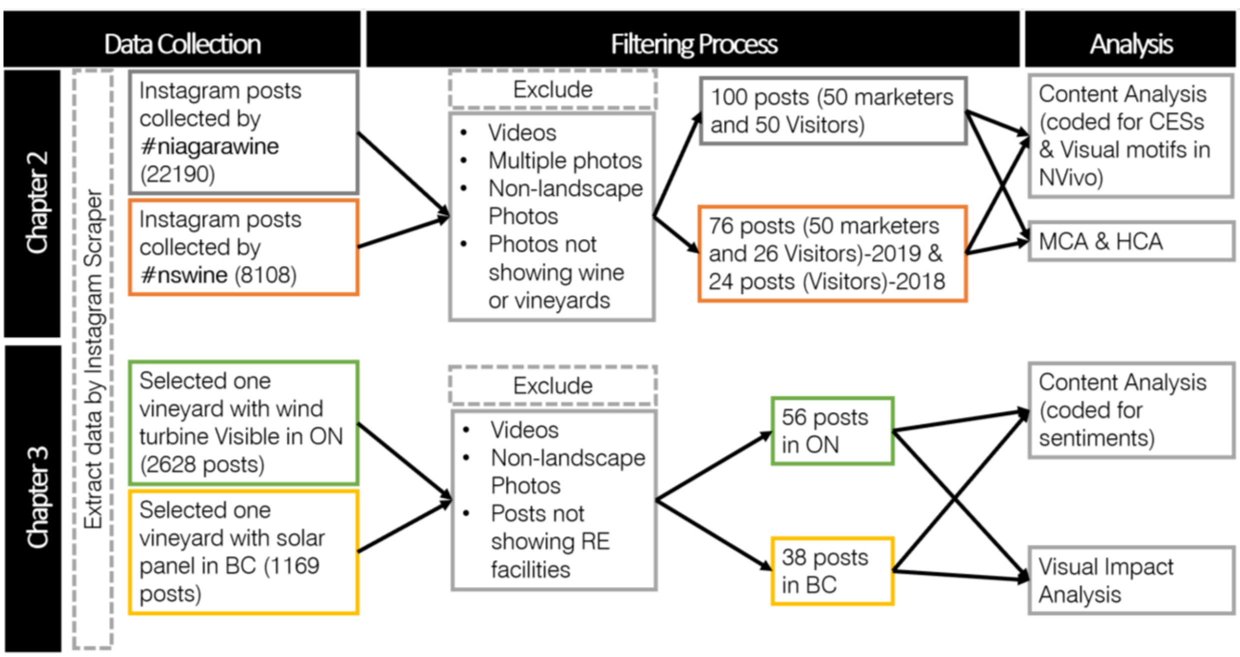

Figure 3. The process of data collection, filtering, and analysis of the study.

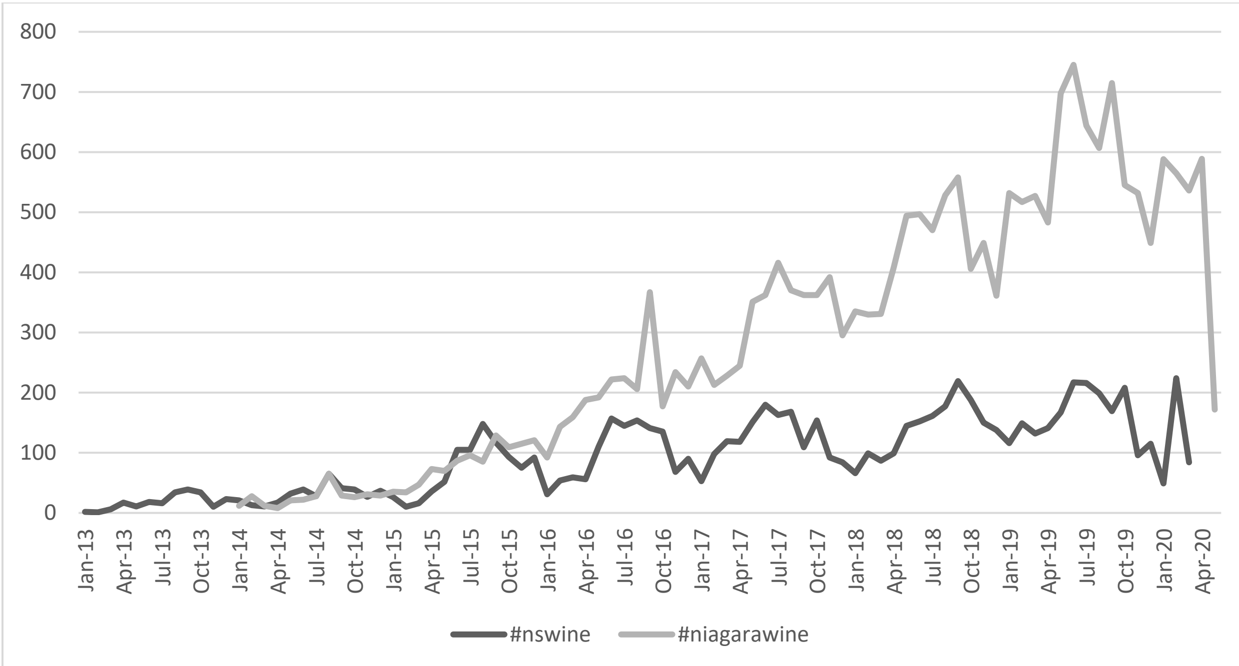

Figure 4. The number of Instagram posts uploaded using #nswine and #niagarawine per month.

We developed a sampling regime based on our goals. With the proliferation of posts in social media, we have access to a large number of materials. However, not every photo can be used in our manual coding research, by contrast with machine learning methods (Y. Chen et al., 2021). Therefore, there must be a filtering process. For Chapter 2 we went through photos posted in 2019 (avoiding any impacts of COVID-19) by using a random selection tool in Excel, building a dataset of 50 visitor and marketer (industry insider) photos for each study area by reviewing and selecting those depicting the vineyard landscape as the majority of the photo area. In chapter 3, we first found target vineyards that had RE infrastructure visible, and then extracted all of the photos from those vineyards and selected only those with RE infrastructure visible.

1.6.2. DATA ANALYSIS

In chapter 2, to analyze our data, images and associated text, we conducted content analysis. Content analysis has been used more with text material, but it can be conducted in cultural studies with photos, including landscape imageries (Stepchenkova & Zhan, 2013). This is a quantitive approach by the help of which researchers can interpret qualitative materials in numbers. This approach aims to find any patterns behind pictorial and text-based materials by counting frequency of any given word (in text) or attributes (in visual materials) (Hsieh & Shannon, 2005; Lian & Yu, 2017), and recording their co-occurrence and clustering (Stepchenkova & Zhan, 2013).

In visual materials, content and composition are the two improtant elements (Albers & James, 1988 cited by Stepchenkova & Zhan, 2013), but we solely focused on the content, since compositional rules are complex and beyond the scope of this study. In our study we used content analysis to establish categories and sub-categories based on our data, helping us to find the dominant themes of the landscape imagery. In this stage, we first coded the photos and accompanying text by the help of NVivo software, and then found the dominant theme of the imagery by looking at counts. Subsequently, we further carried out statistical analysis, including Multiple Correspondence Analysis (MCA) and Hierarchical Cluster Analysis (HCA) on MCA results in chapter 2 to understand the patterns underlying our data, specifically how the user groups (visitor versus marketer) and study areas differed in the visual motifs and CES used.

In chapter 3, in addition to content analysis, we developed an innovative method to conduct a visual impact assessment. We digitally removed the infrastructures with the help of Adobe Photoshop 21.2.3 and then created saliency maps for each original and modified photo using MATLAB. A saliency map is a grayscale map showing the prominence of the visual objects in a photo, emerging in recent landscape change research (Dupont, Ooms, Antrop, & Van Eetvelde, 2016; Dupont, Ooms, Antrop, & Van Etvelde, 2017). To every pixel of this map, a value is assigned, from zero, which is the least prominent, to 255, which is the most prominent. Subsequently, using ArcGIS Pro 2.5.0., we calculated the average delta (i.e. saliency change) value for the area occupied by RE infrastructure in the frame, to understand the level of saliency of the RE infrastructure in the visuals. Detailed information is available in chapter 3.

1.7. THESIS STRUCTURE

In the following chapters, we will answer all the abovementioned research sub-questions. We present chapters 2 and 3 in a paper-based format. We conclude our work in chapter 4.

Chapter 2 and chapter 3 are presented in paper format, as we plan to publish them in international journals, provisionally targeting “Tourism Recreation Research” and “Landscape and Urban Planning,” respectively. I am the lead author for both. My supervisor (Kate Sherren) and committee member (Tuihedur Rahman) collaborated on the project by helping develop the research design, guide the execution of the research project, and review the writing, and will co-author both chapters. Dr. Rahman additionally supervised the statistical analysis of Chapter 2, instructing and assisting on MCA and HCA. Yan Chen, a PhD student, assisted in data collection for Chapter 3 and will be a co-author of that chapter.

CHAPTER 2: TERROIR AS A HYBRID ECOSYSTEM SERVICE IN VINEYARD LANDSCAPES: A SOCIAL MEDIA APPROACH IN NOVA SCOTIA AND ONTARIO

Briefly: Extending ES framework by adding the idea of "terroir", this study showed that sense of place in the context of amenity landscapes has multiple dimensions and it is one of the richest values in vineyards.

2.1. INTRODUCTION

Rural areas have undergone a transition to tourism in many parts of the world where traditional resource industries have declined (J. Holmes, 2012), paving the way for tourism growth as an economic diversification strategy to improve the local economy (Rid, Ezeuduji, & Pröbstl-Haider, 2014). Although some undesirable effects on rural society has been reported as the result of rural transition to tourism (Redmond, 2008; Sherman, 2018; S. Xu et al., 2016), it has been shown that small-scale tourism and recreation contribute to: conservation benefits from a reduction in industrial agriculture and resource extraction (Holmes, 2014; Redmond, 2008); economic benefits from increased value of agricultural products and job creation (Chuang, 2010; Holland et al., 2014); and landscape quality like cultural and aesthetic values of rural areas (van der Sluis et al., 2019; S. Xu et al., 2016). Therefore, these evolutionary processes in rural contexts can either be considered "creative destruction" – when introducing a new function destroys the existing functions in rural areas– or "creative enhancement" – when introducing a new function co-exists with the previous ones (Mitchell, 1998, 2013). Three key factors play decisive roles in the outcome of transition in such amenity rural areas, including consumer demands, internal geography, and stakeholder ideology (Mitchell, 2013).

The expansion of viniculture geographically and the experiential development of the vineyard 'cellar door' concept (once focused on sales only), is one of the drivers of such transitions. Many of these vineyards have emerged in regions where wine production was not among their traditional culture (Carmichael & Senese, 2012), and such landscapes have become destinations for a variety of users whose experiences shape rural economic development and decision making. Motivations to visit vineyards are more than just drinking wine, and include "festivals, socializing, day out, country setting, vineyard destination, other attractions, learning about wine/winemaking (education), eating at winery/picnic/barbeque, tours of the winery, meeting the winemaker, and entertainment" (Dougherty, 2012, p. 160), and these have consequences for further development of rural areas.

Terroir is one of the strategies for rural economic development involving viniculture. terroir is a French word derived from "terre" (land). According to the International Organization of Vine and Wine (OIV; www.oiv.int), "terroir" refers to the unique characteristics of the goods and products stemming from a particular place where "collective knowledge of the interactions" develops between growing practices and environment. Therefore, interactions among the association of the "place, including specific soil, topography, climate, landscape characteristics and biodiversity features, and human factors contribute to terroir" (Van Leeuwen & Seguin, 2006, P.1). In this usage, place is not just a geographic location (Smith, 2015; Trubek, 2008 cited by Marlowe & Lee, 2018) , but it is a co-creation of individuals and environment. This usage of place in the terroir concept is aligned with but distinct from the definition of sense of place as intangible meanings created by human interactions with tangible geographic settings (Campelo, Aitken, Thyne, & Gnoth, 2014), or "topophilia" - coined by Tuan in 1975 – and defined as "the affective bond between people and place." Contributing to a sense of place are: place attachment, related to time spent in a place (Relph, 1976); place meaning, which is often different between residents and visitors (Kudryavtsev, Stedman, & Krasny, 2012; S. Smith, 2015); and, the physical attributes of an environment which afford, or serve as settings for, a set of activities (Najafi & Kamal Bin Mohd Shariff, 2011). Thus, sense of place and terroir are both concerned with the relationship between people and their environment.Sense of place is also a category within most ecosystem services (ES) frameworks. ES are defined as tangible and intangible benefits that individuals obtain from ecosystems (Millennium Ecosystem Assessment, 2003), or using the language of IPBES, Nature Contributions to People (Díaz et al., 2015). The four key categories of ES are provisioning (material goods), cultural (experiences and understandings), and regulating (moderating effects), all of which are dependent upon supporting services (ecological cycles). Bundles of ES have been identified in many landscapes as the result of complex interactions between different land-use types and human nature (Jin, Deng, Chu, Li, & Wang, 2017). Identifying bundles is important in planning conservation strategies, since targeting particular services can help other services to improve as well (achieve synergy) but they can also help the understanding of tradeoffs (Raudsepp-Hearne, Peterson, & Bennett, 2010; Rodríguez et al., 2006). For instance, agricultural lands are one of the key land-use types creating cultural landscapes (Zimmermann, 2006), thus cultural ecosystem services (CES) such as aesthetics, recreation and ecotourism, as well as cultural heritage value, are often associated with agricultural lands (Balázsi et al., 2021). A recent study shows that, in vineyards, CES bundles are context-based and vary by beneficiary (Winkler & Nicholas, 2016). It has also been shown that maintaining bundles of services such as aesthetic and cultural heritage values in vineyard landscapes also provides suitable conditions for a wider range of bird biodiversity (Assandri, Bogliani, Pedrini, & Brambilla, 2018). Therefore, identifying and preserving bundles of ESs in such places is of imprortance in tourism decision making as well as conservation planning.

Relational values have been introduced more recently to account for values that cannot be considered as existing groups in the ES framework (Chan et al., 2016). Unlike the four traditional ES categories, which are hypothesized flows from nature toward people, relational values represent two-way relationships between people and place (e.g. stewardship) or between people in a place (e.g. social cohesion and mutual responsibility). As such, relational values are dependent on humans, unlike either instrumental ecosystem services or intrinsic values of nature, and are non-substitutable in economics terms (Himes & Muraca, 2018). Part of relational values is the 'Good Life', or Eudemonism, which can be connected to happiness and wellbeing emerging from ethical human-nature interactions (Chan et al., 2016).

Terroir can create similar relational and eudaimoic satisfaction for landscape users who consume place products in a place with others. The concept of terroir thus includes elements of cultural, provisioning and relational ES, all playing out in rural wine destinations. Terrior tourism has emerged based on the unique experiences of regions and vineyards (Marlowe & Bauman, 2019), which is different from wine tourism in the sense that it provides a readymade "sense of place" for their users. In terroir tourism the history, landscape and culture of the area, as well as wine or food, are all variously consumed by visitors, often in groups (Marlowe & Lee, 2018; Tresidder, 2015). Despite all this, terroir does not fit comfortably in the existing ES framework which treats entities in ecosystems as possessing either intrinsic or instrumental values (Himes & Muraca, 2018). terroir is a nexus of different ES.

This paper compares the content of Instagram images and captions posted by vineyard visitors and industry insiders in Nova Scotia (NS) and Niagara, Ontario (ON), wine regions to explore terroir-based ES production and consumption using a unique methodological approach. These wine regions are emerging and established, respectively, and each has its own terroir, as recognized through appellations such as Tidal Bay (Wine Growers Nova Scotia, 2021) and Niagara Peninsula (The Niagara Peninsula, n.d.). We begin the paper with some background on the use of images, and specifically social media images, in ES and landscape research, including some of the ethical challenges involved. We subsequently explore how visitors and market insiders portray the two wine regions, identifying common visual motifs and delivery of CES, and investigating the role of terroir. In so doing, we use a collage-based method of data visualization to manage the privacy and copyright concerns around using social media in research, which are explored further below. Finally, we conceptualize how experiences and portrayals of wine regions fit in the ES framework.

2.2. BACKGROUND

Numerous studies have been carried out to assess ES, (Fisher, Turner, & Morling, 2009), although CES has received less attention (Chan et al., 2012). CES are difficult to measure in economic terms due to their intangible nature (Cheng, Van Damme, Li, & Uyttenhove, 2019; Langemeyer, Calcagni, & Baró, 2018; Plieninger, Dijks, Oteros-Rozas, & Bieling, 2013). Therefore, more in-depth, qualitative research is required to identify and assess CES (Cheng et al., 2019). Qualitative methods in this context are varied, including traditional methods, such as interviews (Schmidt, Walz, Jones, & Metzger, 2016), questionnaires (M. Smith & Ram, 2017), focus groups (Stålhammar & Pedersen, 2017), and observations (Unnikrishnan & Nagendra, 2015) as well as newer methods, including participatory mapping (Klain & Chan, 2012), Q method (Winkler & Nicholas, 2016), and expert-based methods (Assandri et al., 2018). Some researchers have also used a mix of traditional methods with newer methods (Blake, Auge, & Sherren, 2017; Dou, Zhen, De Groot, Du, & Yu, 2017). More recently social media, including visual content, have been used in this context (Y. Chen, Caesemaecker, Rahman, & Sherren, 2020; Y. Chen et al., 2019).

Working with visual data requires different considerations than textual data. With visual materials, important elements include content, composition, the context of production and publication, as well as how it is recieved (Albers & James, 1988 cited by Stepchenkova & Zhan, 2013, Christmann, 2008). Most existing visual analysis methods cannot emphasize all of these components simultaneously (Table 2) (Christmann, 2008). Scholars tend to focus on the content of the photo and/or composition (how contents are combined), and they interpret them from two different perspectives: literal (assuming there is no hidden meaning) or metaphorical (trying to understand any hidden meaning) (Stepchenkova & Zhan, 2013). These options shape the typical analytic methods used (Table 2).

Table 2. Methods of photo analysis

	Element of Visuals				Perspectives	
Methods	Content	Composition	Context	How Received	Literal	Metaphorical
Content Analysis	✓				✓	
Thematic Analysis	✓	✓				✓
Semiotic Analysis	✓	✓			✓	✓
Iconography /Iconology	✓	✓	✓	✓		✓

(adapted from Christmann, 2008; Stepchenkova & Zhan, 2013)

To understand the meanings associated with photos, scholars have used varied methods. Some scholars use content analysis. This is a quantitive approach to identify any patterns behind pictorial materials by counting the frequency of visual attributes in the data (Hsieh & Shannon, 2005; Lian & Yu, 2017), and sometimes recording their co-occurrence and clustering (Stepchenkova & Zhan, 2013). Another way to analyze visual data is thematic analysis (Lowe-Calverley & Grieve, 2018; Shanahan, Brennan, & House, 2019), in which researchers assign and aggregate codes into conceptual themes across the entire visual data (Braun & Clarke, 2006; Langmann & Pick, 2017). However, with this method deep interpretation of social media images is difficult because it usually involves large numbers of photos (Shanahan et al., 2019). Another analysis approach is semiotic analysis which treats photos as a whole entity, in which content and composition of the image play an important role (Christmann, 2008). Researchers interpret the literal signs (elements) and hidden meanings (Hunter, 2016), something typically unable to be done by cultural outsiders (Langmann & Pick, 2017, p. 113). Similarly, iconography/iconology is another approach particularly used when photos lack accompanying text to convey the photographer/s' intentions (Drainville, 2018). This method bears certain similarities to semiotic analysis in terms of seeking beyond the literal meaning of visuals; however, it moves a step further and uses "content and interpretation" to develop a full understanding of a photo in its context (Langmann & Pick, 2017, p. 116). A high degree of subjectivity (Stepchenkova & Zhan, 2013) is associated with semiotic and iconography/iconology analysis.

Recently, scholars who leverage words and phrases in secondary data to study human culture have coined the term culturomics (Michel et al., 2011; Sherren et al., 2017). To study human culture, Michel et al., (2011) searched through digital books for changes in the frequency of particular words and phrases, essentially doing a content analysis of texts (Ladle et al., 2016; Michel et al., 2011). With the proliferation of visual media, some scholars argue that culturomics should incorporate images along with text to study human culture (Sherren, Smit, Holmlund, Parkins, & Chen, 2016). Several studies have used this concept to identify CES associated with the landscape (Y. Chen et al., 2020; Hale, Cook, & Beltrán, 2019; Oteros-Rozas, Martín-López, Fagerholm, Bieling, & Plieninger, 2018), including those associated with landscape alternatives to inform decision-making. This content analysis approach with photos uses counts of features and is effective to reveal patterns; manual coding of features can be done with small datasets or increasingly by using automated methods such as artificial intelligence with Big Data (Y. Chen et al., 2021; Langmann & Pick, 2017). The difference between this method and thematic analysis is that in thematic analysis researchers are not required to break photo elements down into categories (Langmann & Pick, 2017). In landscape culturomics, the content categories often sought in photos cover three of the four dimensions of the landscape perception model of Taylor, Zube, and Sell (1987) (excluding the expert paradigm which is interested in how knowledgeable third-parties assess landscapes): physical landscape elements (psychophysical paradigm), expressed landscape values (cognitive paradigm), and activities evident or affordances (experiential paradigm) (Y. Chen et al., 2019). In our research, we build on the concept of culturomics, using documents from social media, including pictures and text, that are shared as means of communication, as proxies for landscape perceptions and values.

Returning to CES, the majority of studies focused on evaluating CESs in recent years have used non-monetary methods, either through directly stated preference or indirectly revealed preference (Cheng et al., 2019). Many of these methods involve spatial methods such as participatory GIS, but some also draw on social media post images and captions to identify areas of significant CES. Many such studies use 'big data' in a relatively unfiltered and automated way, assuming that a photo shared is a service delivered (Sherren et al., 2017); more qualitative approaches emerging from the social sciences sample posts into 'small data' that is interpreted manually (Y. Chen et al., 2021). Though some consider only counting images, words, and so on as culturomics, we carefully sampled our data and used more qualitative content analysis approaches on the resulting small data. Compared to all the aforementioned methods of photo analysis, content analysis is the most replicable (Stepchenkova & Zhan, 2013).

Images, especially those shared on online platforms, are powerful tools in shaping and communicating what a 'good experience' in a given place should be. This is because of the 'process of selective attention' (Sottini et al., 2019b): the content of such images depicts the preferences of their photographer as a person who experienced the landscape, spent time selecting among images, and finally shared them online. Image-based social media such as Instagram is where many people share their daily lives, including how they conceive of and construct a 'good life', in contrast with platforms like Twitter that are more opinion-oriented (Y. Chen et al., 2019). Such platforms are also used by marketers who seek to shape what is seen as a desirable experience, using the repetition of motifs. Motifs are distinctive repeating attributes or features conveyed visually in images and/or verbally, such as hashtags in captions (Filieri, Galati, & Raguseo, 2021; Filieri, Yen, & Yu, 2021). Visual material viewed on social media – also called projected images – tend to be replicated by visitors to the same places (Stepchenkova & Zhan, 2013). At the same time, visitors can create their own image of a place, known as organic images, which can also be projected, influencing the future potential consumers of the place (Lund, Cohen, & Scarles, 2018; Martin, Woodside, & Dehuang, 2007), and thus serving as an important resource for destination marketing organizations (DMOs) (Michaelidou, Siamagka, Moraes, & Micevski, 2013). Moreover, in destination branding contexts that highlight the importance of destination uniqueness using sense of place models (Campelo et al., 2014), researchers study user-generated photos to understand the distinctiveness of a place and inform the marketing of place identity (e.g. Filieri, Yen, et al., 2021; Heikinheimo et al., 2017). Other research looks at how destinations market themselves (e.g. Ge & Gretzel, 2019; Lian & Yu, 2017), but few studies look at both visitors and marketers as we do here (e.g. Stylidis, Belhassen, & Shani, 2015; Michaelidou et al., 2013; Rossi, Barros, Walden-Schreiner, & Pickering, 2020).

2.3. METHODS

2.3.1. STUDY AREAS

This study used wine regions of Niagara, ON and NS which are tourist destinations located in rural areas. Having varied tourist attractions, including wine routes, the Niagara region draws more than 13 million tourists from around the world each year (Tourism, n.d.). ON is the oldest wine-growing region in Canada, and is well-established in the wine industry, accounting for around 70% of all Canadian wine production (Industry Facts, n.d.). ON has several wine-growing regions, including Niagara Peninsula, Prince Edward County and Lake Erie North Shore, and Pelee Island (ON Wine Industry Facts Archives, n.d.), but the Niagara region comprises more than 90% of ON's industry (Chris Choi, Huang, Flaherty, & Khazaei, 2017; Industry Facts, n.d.) with 97 wineries (Tourism, n.d.). In contrast, NS, with around twenty wineries most in the Annapolis Valley, is one of the emerging vineyard regions in Canada (Jantzi & Mcsweeney, 2019). In 2015, the NS wine industry had an overall economic impact of $218.4 million and wineries brought approximately 112,000 tourists into the region (Rimerman & Eyler, 2017). Although NS is only the fourth most important wine-growing region in Canada (Rimerman & Eyler, 2017), it considerably contributes to the province's economy. Considering the differences in provincial contexts and the different stages of wine industry development, the study areas provide a useful comparison.

2.3.2. DATA SOURCE

Instagram has become a powerful source of data for social research for several reasons. This online platform encourages its users to share their everyday rather than extraordinary experiences (Y. Chen et al., 2021). Comparing Flickr, Twitter, and Instagram as photo-sharing platforms, Instagram possesses the highest number of posts (Tenkanen et al., 2017). Given its rate of posting (995 photos per second)(Aslam, 2021), researchers have access to a large amount of material, which is also cost-effective (Y. Chen et al., 2018; Matteucci, 2013). Additionally, it allows researchers to identify geographic locations of posts using geotags that can be linked to the posts. Furthermore, Instagram has facilitated hashtags since January 2011 (Kolowich Cox, 2014), and these hashtags are being increasingly used to annotate images (Ferrara, Interdonato, & Tagarelli, 2014; Giannoulakis & Tsapatsoulis, 2016), which can help researchers to better understand the contents of and intentions behind photographs. A recent study illustrated that 66%

of the hashtags used with each post are meaningfully descriptive of the image content (Giannoulakis & Tsapatsoulis, 2016), which supports our use of both text and image.

Despite these advantages, there are also drawbacks associated with using social media in research. Research with online platforms has recently become more challenging due to the retirement of APIs in recent years. The "post-API age" has been coined to emphasize the importance yet challenges of social media research by highlighting web-scraping approaches using third-party applications and the consequences of violating the terms of use in doing so (Freelon, 2018; McCrow-Young, 2020). Some researchers argue that social media data are biased and are often skewed towards a very small proportion of the population, and thus are not representative of the whole population (Zagheni & Weber, 2015). For instance, Instagram is more likely to be used by younger individuals (Y. Chen et al., 2019). Furthermore, duplicate posts and repeat posts from single users can bias Instagram data. Researchers can also find it challenging to balance privacy and copyright concerns. To address the privacy issues associated with Instagram data, some scholars anonymize data and blur images before publishing their studies (McCrow-Young, 2020). However, these approaches can violate the exclusive right of the creator. In contrast, copyright can be protected by giving credit to data generators (Y. Chen et al., 2018), which can in turn violate users' privacy (Sbragaglia, Correia, & Di Minin, 2021). To avoid these issues, Sherren et al. (2017) recently advocated the use of collage to convey the aggregate experiences in a place, illustrating themes within the data by digitally combining posted images in ways that individual photographs are not longer identifiable. We pilot this approach in this paper.

2.3.3. DATA COLLECTION AND FILTERING

A common approach of collecting data from social media is to use 'identifiers' such as hashtags (Dorfman, Vaca, Mahmood, Fine, & Schierle, 2018; LaMarre & Rice, 2017; Moreno, Ton, Selkie, & Evans, 2016) and geotags (Y. Chen et al., 2018, 2019; Figueroa-Alfaro & Tang, 2017; Martínez Pastur, Peri, Lencinas, García-Llorente, & Martín-López, 2016). Hashtags are metadata tags, which are the prefix of "#" with a word or a set of words (Davarpour, Sohrabi, & Naderi, 2019) and are mostly used by researchers to identify specific topics unlike geo-tags which are used to target specific geographic locations. However, geotags are not the only indicators of geographical locations. A recent study has categorized hashtags into geographical hashtags and content hashtags (Davarpour et al., 2019). Thus, researchers have more than one option when the geographical location of a study is the focus, and a geographical hashtag may be more useful for studying a diffuse place, like a wine region, than specific geotags would allow for. Combining a topic and geography leads also to a hashtag solution, because social media scraping tools will only typically accept one argument (geotag or hashtag). An illustration of this is a recent study using #iLoveLondon to collect user-generated posts on Instagram to study destination love (Filieri, Yen, et al., 2021). Selecting an appropriate hashtag can be challenging, however, due to variations in language use (X. Chen, Vorvoreanu, & Madhavan, 2014). In our study, we examined many different hashtags that were indicators of both our case studies' locations and the topic through the publicly available posts on Instagram, (e.g. #novascotiawinecountry, #novascotiawine, #nswine, #novascotiawines, #novascotiawineries, #winesofnovascotia, #niagarawine, #niagarawineries, #niagarawinery). We selected the most popular hashtags for each region, which had the highest numbers of posts - #nswine and #niagarawine. Using Instagram scraper which is a command-line tool written in Python, we collected all the #nswine and #niagarawine posts uploaded until March-2020 which were 8108 posts and 22190 posts, respectively.

The metadata extracted by the Instagram scraper stored in JSON files was then converted to .XLS format (https://json-csv.com/). This file included links to photos, number of likes, user id, hashtags, captions, and publication dates. We initially selected posts uploaded in 2019, avoiding the COVID pandemic, and developed a sampling regime by using a random selection tool in Excel (Fig. 4). There are two main groups of relevant Instagram posters tagged with #nswine or #niagarawine – industry insiders and vineyard accounts (hereon in, marketers) post about products and experiences they offer, and visitors share their experiences with those things. We aimed to use a total of 200 photos, half for NS and half for ON, of which 50 photos were from visitors and 50 from marketers, a reasonable number for such qualitative studies (Y. Chen et al., 2020). We collected the first 100 relevant randomly selected photos of marketers and visitors for each case. To understand to which group the posts belong, we visited their profile. This process also involved filtering since the data was noisy, containing many posts not related to winery landscapes. We excluded videos, selfies, posts using the album feature of multiple pictures, and reposts. Because of our interest in ES, we also excluded photos at which less than half comprised landscape or that did not seem to be taken at a vineyard. In the NS case study, we could only find 26 visitor photos uploaded in 2019 that met our criteria. To reach 50 photos, the same random process was used for photos of 2018. If there were multiple photos from a one-image post, we chose the bigger photo and when they were the same size, we captured the first photo. Then we created a PDF version of each post, and finally imported them into NVivo 12 for coding process.

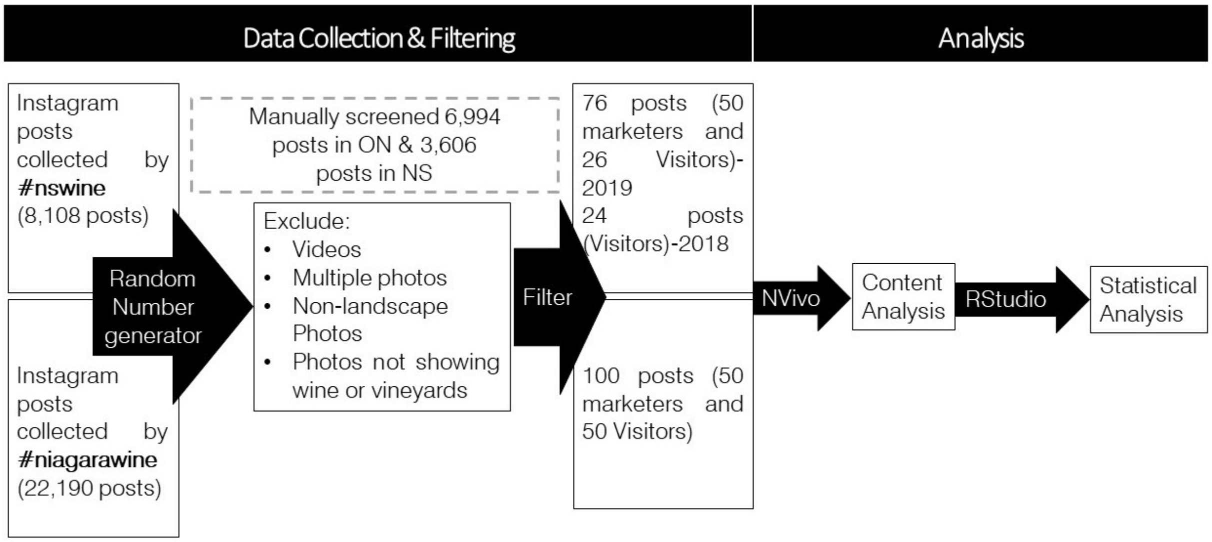

Figure 5. The steps undertaken for data collection, filtering, and analysis.

2.3.4. DATA ANALYSIS

According to Banks (2018) photo analysis requires investigation of both internal narratives and external narratives. Internal narratives include what is explicitly shown, typically implemented as content analysis of features or motifs. External narratives are more associated with each photographer's view of the photo, what practice it is associated with, which can be identified with the help of captions and hashtags. The coding strategy used for this study was a hybrid of deductive and inductive approaches to content analysis (Elo & Kyngäs, 2008; Kyngäs & Kaakinen, 2020), drawing on text and photo content. The visual features and motifs were coded inductively from photos, using captions to help with interpretation. We then investigated captions and hashtags in detail to code CESs deductively as categorized in the Millennium Ecosystem Assessment (Millennium Ecosystem Assessment, 2005), typically identifying subcategories inductively (Table 3). The categories included recreation and ecotourism (when landscapes afford tourism and recreation), sense of place (foster belonging and attachment), aesthetic value (show great beauty), social relation (serve as meeting spots for people), educational value (provide opportunities for research and study), inspirational values (inspire arts and creativity), spiritual and religious value (embody spiritual and religious values), and cultural heritage value (host cultural and historical values). We found subcategories within the recreation and ecotourism category, including tourism, wine tasting, events, and physical activities. Additionally, subcategories of sense of place were identified, including sense of belonging (people feel they fit in a place), terroir-consumption (TC; people eat and drink local products of landscapes), terroir-production (TP; landscapes are an environment to grow and create products/food/drinks), and a related category, award-winning (landscapes enable people the satisfaction of competing and winning an award, in this case for their wine).

Table 3. Coding themes and their verbal and visual indicators.

CES	**Sub-Categories**	**Textual Indicators**
Recreation & Ecotourism	Tourism	#explorenovascotia, #tourism, #discovernovascotia, #visitniagara, #winerytour, #winetravel, and so on.
	Wine Tasting	#Winetasting, "great little tasting," and so on.
	Activities	#biketour, #Winewanderlust, stroll, yoga, #picnic, hike, a good horse.
	Events	#winerywedding, #event, Tickets, festival, #icewinefestival, Movie nights, and so on.
Sense of Place	Terroir-Consumption	#drinklocal, #localvore, #coolclimatewine, #dineinthevines, and so on.
	Terroir-Production	#harvest2019, saline aroma that characterizes the vineyard, #viticulture, and so on.
	Sense of belonging	#Valleygirl, #nslocal, #supportlocal, #Haligonian #athomeinhalifax, #novascotialife#canadasworld #eastcoastlife, #homesweethome, #home, #valleylife, #mywinecountry and so on.
	Award winning	Award winning, international (wine) superstars.
Aesthetic Value	_	beautiful view, paradise calling, #beautifulnovascotia, AMAZING view, #scenery, poetic landscape, #nofilter, and so on.
Social Relation	_	#famjam, Friends, Making a free phone call [from the phone booth located in the Luckett vineyard], festival, #drinkingwithfriends, #createcommune, company communities and supporters, #travelingtogether, and so on.
Educational Values	_	Classroom, #school, #learning, #fieldtrip, learning, Today's question, stories from the winemaker, article.
Inspirational Value	_	#winephotography, #landscapephotography, #naturephotography, #photooftheday, #picoftheday, and so on.

Spiritual & Religious	_	#hiscreation
Cultural Heritage Value	_	#acadian #tradition

Next we treated the results of the above content analysis to Multiple Correspondence Analysis (MCA) to understand the overall underlying patterns between region, stakeholder, feature/motif and CES (Y. Chen et al., 2020; Oteros-Rozas et al., 2018; Plieninger et al., 2013). We used MCA for several reasons. First, MCA has application to a wide range of fields, including human behavior research (Khangar & Kamalja, 2017). In addition, an MCA biplot provides a clear, easily comprehensible visualization of the variables' associations (Ceylan, Çizel, & Karakaş, 2021). Moreover, compared to other statistical methods which investigate the pairwise correlation between two variables, such as Chi-squared Tests with categorical data and Pearson's correlation with continuous data, MCA allows researchers to find multivariate interrelationships between categorical variables (Abdi & Valentin, 2007), for which data should be classified in binary categories. Furthermore, MCA is a distribution-free method (Ganiere, Chern, & Hahn, 2006) which converts qualitative data into quantitative measurements, so that we can gain a better understanding of how the variables are organized. To prepare the data for MCA we removed extremely common and uncommon codes, including motifs and CESs, and only selected those with frequency from 10% to 85% in our data (Figure 5). This data cleaning process was carried out to avoid excessive homogeneity in the dataset.

Finally, because the MCA only shows the first two dimensions of the variables' relationships, and it does not give us any distinctive groups such as variables with similar characteristics, another step was necessary. Thus, we carried out a Hierarchal Cluster Analysis (HCA) on the MCA results to identify bundles of CES and motifs (Plieninger et al., 2013) in which each cluster included observations that tend to co-occur in photos (Bejaei, Cliff, & Singh, 2020). The number of clusters was limited to a maximum of five since the first five dimensions explain maximum variability and their eigenvalues are more than one. RStudio 1.4.1106 (RStudio Team, 2021) and three packages, including the FactoMineR (Le, Josse, & Husson, 2008), the ggplot2 (Wickham, 2008), and the ggrepel (GitHub - Slowkow/Ggrepel: Repel Overlapping Text Labels Away from Each Other., 2021), were used for these statistical techniques. Our data was also divided by the location of the study sites to better understand the CES and motifs of different landscape contexts.

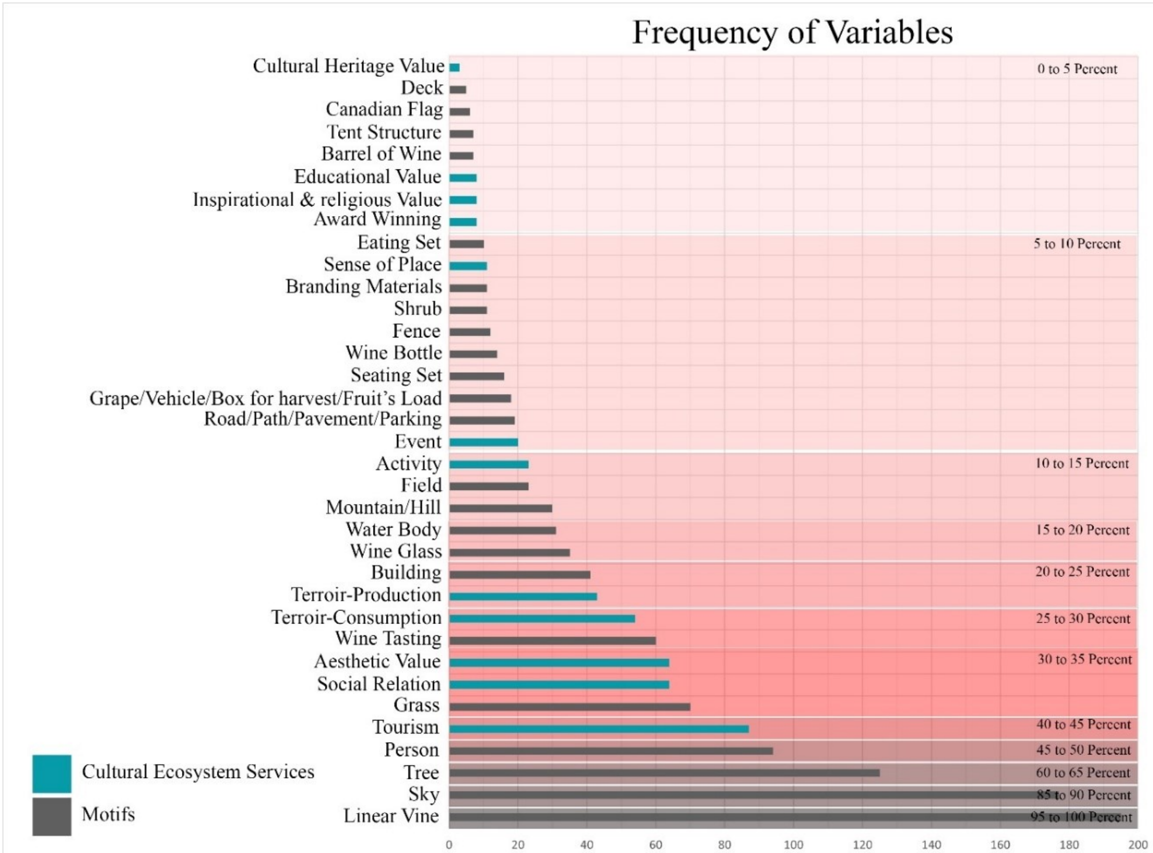

Figure 6. The frequency distribution of CESs and motifs within our dataset.

2.4. RESULTS

CES classes have already been described above, coded using a mix of deductive (category) and inductive (subcategory) modes. Motifs were coded inductively and grouped later into five categories (Figure 6), including wine consumption, wine production, natural, man-made, and people. These two sets of codes, representing external and internal photo narratives respectively, are discussed in detail in the following, comparing their prevalence across the two study areas, before describing the bundles that emerged through statistical analysis.

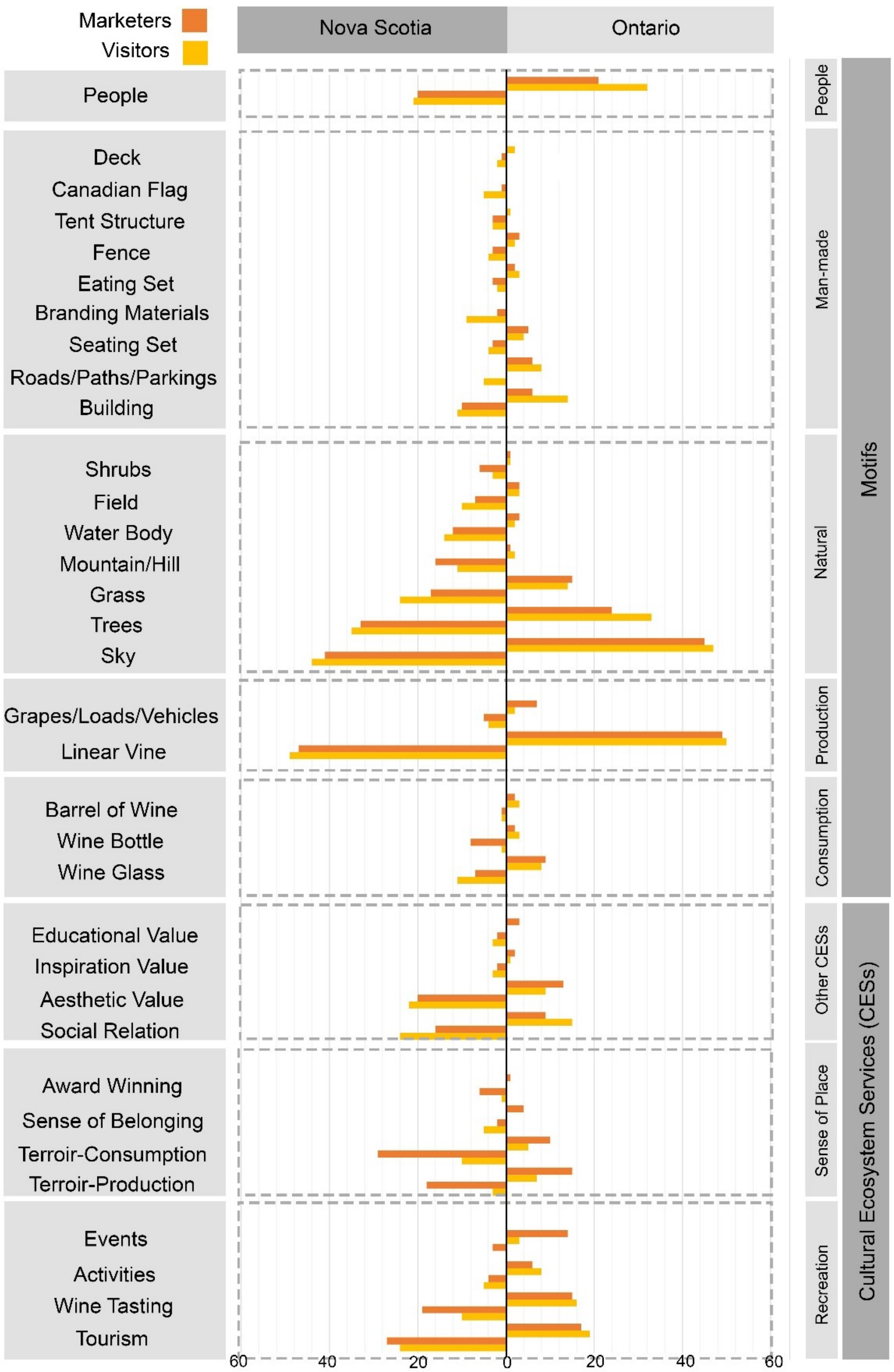

Figure 7. Cultural ecosystem services (CESs) and motifs identified through marketers and visitors experience across the case studies.

The X-axis indicates the number of posts mentioning motifs/CESs.

2.4.1. DATA DESCRIPTIONS OF MOTIFS AND CESS

Content analysis indicates that the features or motifs were quite similar between the regions: the most frequently photographed motifs include linear vine, sky, tree, and grass (Figure 6). However, there are some differences related to geography and marketing. NS photos include more body of water, mountain/hill, Canadian flag and specific branding material (e.g. Luckett Vineyard's phone box). Geographically, some differences arise because Nova Scotia has more variety in biophysical landscapes than ON. However, the presence of people and road/path/parking were more common in ON. A possible explanation is that the Niagara wine region is nearer a large city (Toronto) and unsurprisingly is more developed in its transportation system, allowing it to attract more tourists than NS. To showcase the experience of the most common motif, linear vines, we used a collage visualization that combines this popular feature from 16 different photos in NS (Figure 7). The geometry of these parallel lines, more than the grapes hanging on them, seem to be a particularly iconic element of a vineyard Instagram posting.

Figure 8. Collage representation of linear vine motifs based on 16 vineyard users' experience in NS.

In terms of external narratives (Table 4), four CES dominate, including recreation and ecotourism (NS=92[1] and ON=98), sense of place (NS=74 and ON=42), aesthetic value (NS=44 and ON=22), and social relation (NS=40 and ON=24). Among the sub-categories of recreation and ecotourism, tourism is more common in NS (1.4 times more than ON, with textual indicators such as #visitniagara, #winerytour, and #winetravel) and wine tasting is highest among marketers in NS (1.9 times more than visitors, with captions including for example #Winetasting, tasting, and "great little tasting"). Events such as, weddings, movie watching, and other festivals, with captions including #winerywedding, #event, Tickets, #icewinefestival, and Movie nights, were not frequent in any cases except for marketers in ON.

Table 4. Cultural ecosystem services (CESs) identified through marketer and visitor experience across the case studies.

Cultural Ecosystem Services	Sub-Categories	Nova Scotia			Ontario		
		Visitors	Marketers	Total	Visitors	Marketers	Total
Recreation & Ecotourism	Tourism	24	27	51	19	17	36
	Wine Tasting	10	19	29	16	15	31
	Activities	5	4	9	8	6	14
	Events	0	3	3	3	14	17
Sense of Place	TC	10	29	39	5	10	15
	TP	3	18	21	7	15	22
	Sense of belonging	5	2	7	0	4	4
	Award winning	1	6	7	0	1	1
Aesthetic Value	N/A	22	20	42	9	13	22
Social Relation	N/A	24	16	40	15	9	24
Educational Value	N/A	3	2	5	0	3	3
Inspirational Value	N/A	3	2	5	1	2	3
Spiritual & religious	N/A	1	0	1	1	0	1
Cultural Heritage Value		0	2	2	0	0	0

[1] The sum of the category could be more than a hundred because subcategories that are being counted are not mutually exclusive.

Within CES, sense of place had complex expressions. Subcategories identified inductively within the overarching category included terroir, award winning, and sense of belonging (Table 3). In addition, terroir has two sub-categories, including TC and TP. TC was coded most often among sense of place sub-categories and was more common in NS posts, but in both regions was more common among marketers (Table 4), possibly because it is used to market wine-related products. TP was also more common among marketer posts, but equally represented across regions. The enjoyment of producing and consuming wine in the regions shows that industry insiders are using terroir tourism strategies to sell the place and products.

Sense of belonging emerged within our dataset with hashtags such as #home, #nslocal, #Valleygirl (referring to the Annapolis Valley where most NS vineyards are based) and so on (NS=7 and ON=4). Although sense of belonging was not as common as terroir categories, it was more common among visitors in NS but marketers in ON. This might be because ON is more likely to attract international tourists than NS region, but it is difficult to draw many conclusions with relatively small numbers. The 'award-winning' theme emerged when individuals felt a sense of pride because a specific vineyard has won an award; it was more common among marketers in NS (NS=7 and ON=1), probably because marketers want to highlight their achievements more than visitors and because NS is an emerging wine region compared to ON.

Aesthetic value and social relation CES were considerably more commonly coded in NS. Although aesthetic value was mentioned approximately equally by different stakeholders, social relation was more common among visitors in both regions, unsurprising as visiting vineyards is not something often done alone.

2.4.2. CES AND MOTIF ASSOCIATIONS AND BUNDLES DIFFER BY STAKEHOLDER, REGIONS, AND TERROIR COMPONENT

The MCA revealed stakeholder and regional differences of CES and motifs (Figure 8). Marketers were more likely to photograph vineyards for TP, while visitors were more likely to photograph vineyards for wine tasting, tourism, wine glasses, people, social relations, TC, grass, aesthetic values, and buildings. Regional differences emerged where NS posts were more associated with aesthetic values, trees, buildings, TC, water bodies, mountains, fields and tourism, whereas ON was more associated with people, TP, social relations, wine glasses, and activities (horse riding, dog walking, walking, and yoga).

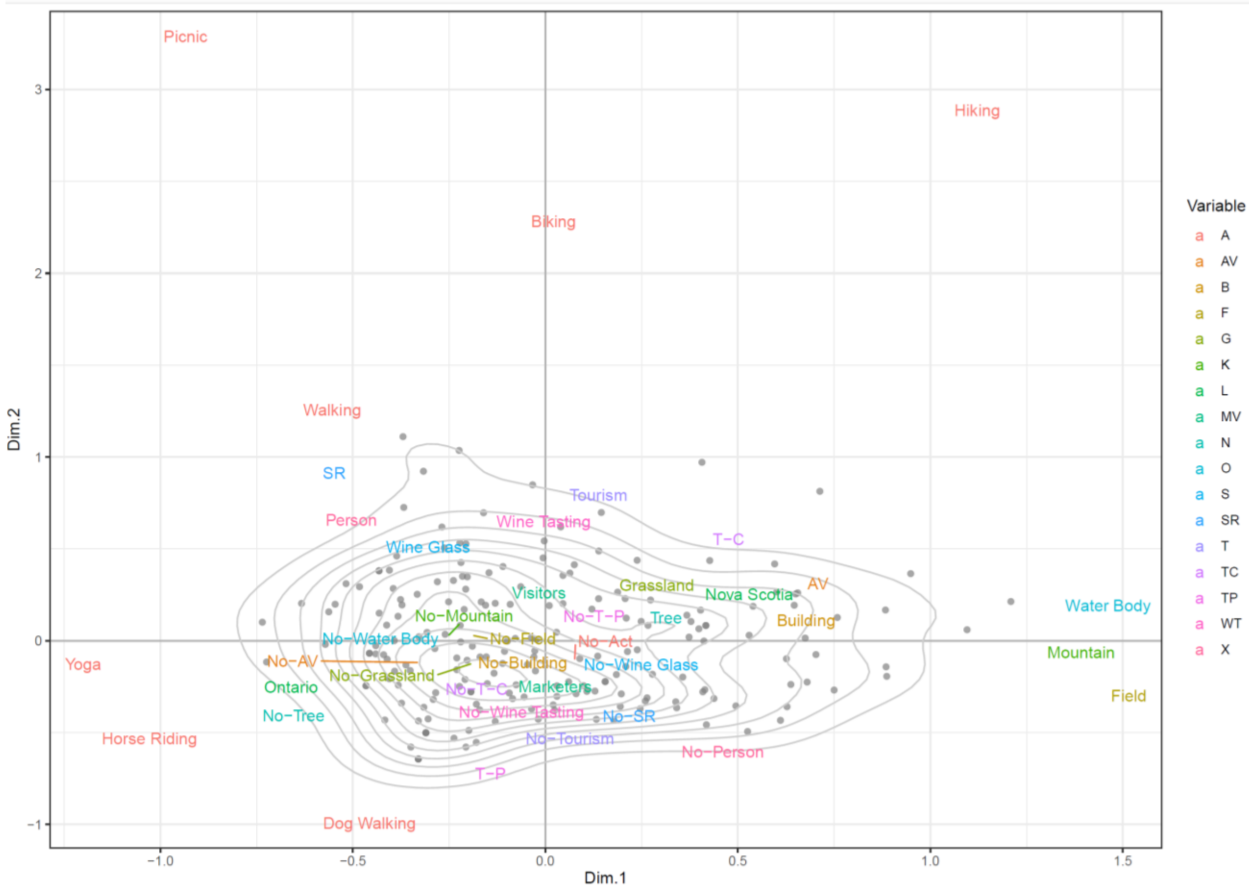

Figure 9. MCA Plots of the association between variables in the case studies.

(A: Activity, AV: Aesthetic value, B: Building, F: Field, G: Grassland , K: Mountain , MV: Marketers, N: Tree, O: Water Bodies, S: Wine Glass, SR: Social Relation, T: Tourism, TC: Terroir-Consumption, TP: Terroir-Production, WT: Wine-Tasting, X: Person).

MCA provides a snapshot of variable associations in only two dimensions (Figures 1S. diagram a to d in the Appendix B), so deeper insights into the bundles was obtained by the outcomes of the cluster analysis (Figure 9). Based on the overall model of all 200 images, out of the first eight dimensions of the MCA with 54.4 % cumulative percentage of variance (Tables S2 in the appendix B), three clusters were identified (Figure 9). Cluster 1 was associated with the NS region. It was strongly characterized by the presence of varied biophysical landscape attributes, including water bodies, fields, and mountains with 87.1%,87%, and 86.7% observations, respectively (based on within-cluster characteristics available in tables S6 in the appendix B). Cluster 2 was characterised by the production of wine (68.20%) in ON (Table S5 in the appendix). Cluster 3 is not associated with either regions or terroir dimensions. There is no significant negative associations between stakeholders in this cluster, although 40% are visitors (Table S4 in the appendix). This cluster is mainly characterised by people's interactions maintained through activities such as walking, tourism, and wine tasting. The overall data did not show any significant distinctions among stakeholders. This may reinforce that there is a reproduction of the same visuals among visitors and marketers. Separate MCA and HCA models for each stakeholder type and region are available in the appendix for those who would like further detail, but we will not address these models here (See appendix B).

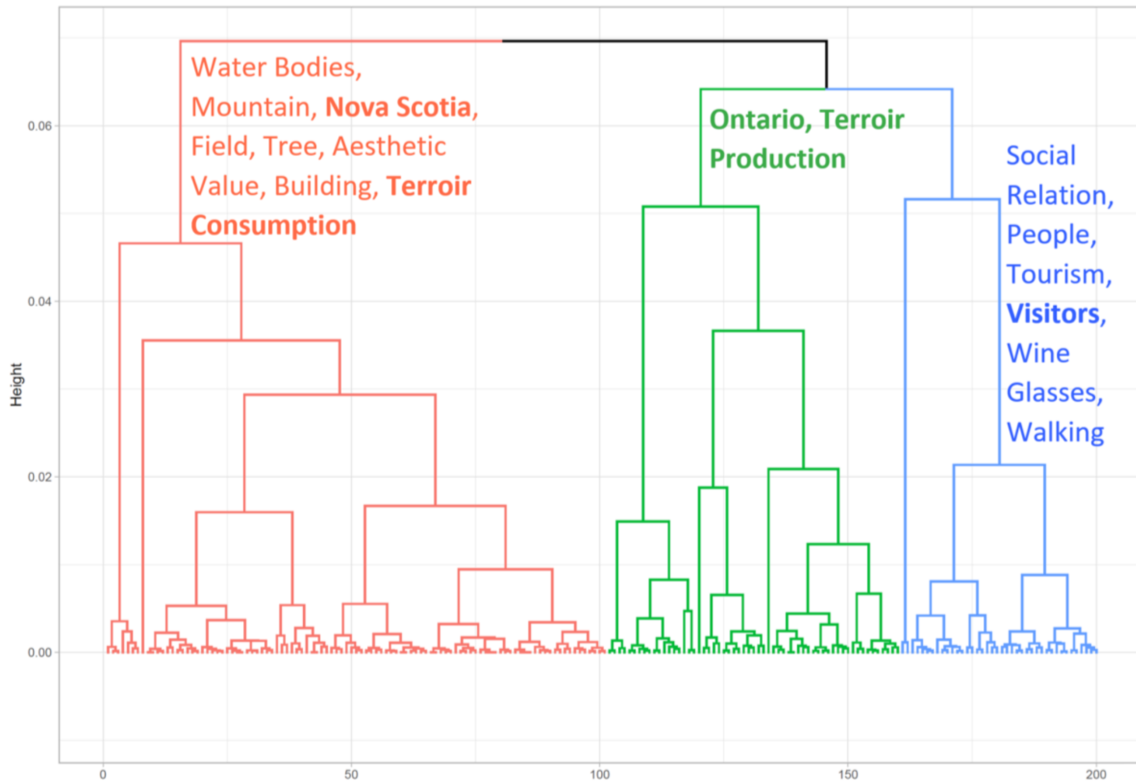

Figure 10. Cluster Dendrograms of the association between variables in the case studies based on all data.

Note colours of clusters are randomly assigned. Bold text indicates important variables for the purposes of this paper.

Regarding the overall diagram, terroir dimensions were distinct. Similarly, the study areas were always in different clusters. The ON region focused on the production aspects of terroir while NS advertised the consumption aspects, perhaps because of the relative maturity of the industry in ON, and thus the maturity of their terroir and related knowledge. Moreover, NS highlighted social relations, a variety of biophysical landscape attributes and consuming wine. However, visitors and marketers bore more similarities than their nuanced differences.

2.5. DISCUSSION

This study was designed to highlight the cultural values and visual motifs of rural landscapes in the context of wine amenity regions. We used landscape-focused posts from ON and NS wine regions made by industry insiders (marketers) and visitors, and applied multivariate statistical tools to establish clusters or bundles of motifs and CES. This helps us to understand the dynamics of amenity landscape transitions for those implicated in it, but leaves aside the implications for the wider host communities, which should be the focus of future work (Calvert, Smit, Wassmansdorf, & Smithers, 2021).

We found that vineyard experiences are context-based and vary slightly in different geographical settings, but that there are some iconic motifs such as linear vines that dominate Instagram posts of that experience. Vanishing points, in our case created by extending parallel linear vines in vineyards, are considered to be one of the important aesthetic elements of a photo in photography literature (Lee, Hong, Kang, & Lee, 2017) which are proven to attract attention (Borji, Feng, & Lu, 2016; Ueda, Kamakura, & Saiki, 2017). This can explain the prevalence of linear vines in photos rather than photos of the grape itself. Thus, the geometry of linear vines is appealing to vineyard users regardless of which group of stakeholders they belong to.

More established wine regions like Niagara had more focus on the production of wine, while emerging wine settings like NS had more focus on the experience and 'consuming' the place. Maintenance of the values and motifs most appreciated by rural landscape users is a key factor in achieving success for further rural development. We discuss our key findings in what follows along three different dimensions: terroir as a hybrid ES, CESs across regions, and stakeholder's experiences and portrayals of wine regions. Throughout the noisiness of social media data is evidenced as a source of uncertainty as well as insight.

2.5.1. TERROIR AS A HYBRID ES

Reflecting on the existing ES framework, we find that there is a conceptual gap in terms of characterizing sense of place in vineyards. In our results, terroir, sense of belonging, and award-winning were classified under sense of place in the CES framework. This indicated that the sense of place concept is complex in vineyards. When we encountered hashtags such as #drinklocal and #drinknovascotia, we realized that the existing CES framework does not include a cultural service that has a food and drink component. We extend the idea of sense of place by the term "terroir" meaning the taste that people obtain because of the soil, topography, weather and skills of the people where the food is originated. Terroir conveys the idea that the person thinks the food or drink belongs and that consuming or producing it is a distinct experience as a result. In the concept of ES, foods are considered provisioning services. However, in our study it has nothing to do with the nutrients, particularly the wine beverage itself.

In the existing framework, sense of place is when landscape users feel they belong to the place. However, vineyard landscape users also feel the wine belongs to the place and they engage with the product in the place in different ways, to consume it and associated local products, and to do so with others, which also provides them with a separate experience In addition, in both terroir consumption and terroir production, terroir is about connection between people in the place or between people and place. Thus, in this sense, terroir is also a relational value.

Based on the literature (Campelo et al., 2014; Tresidder, 2015; Van Leeuwen & Seguin, 2006) and our findings, terroir seems to be the entanglement of provisioning (wine, food), cultural (aesthetic), and relational (the good life) services (Figure 10). Although our methodological approach did not allow us to confirm whether all the dimensions of terroir sit at the intersection of the aforementioned categories, it did show us that it has two distinct dimensions (see next paragraph). It is necessary, however, to flesh out this concept further in future studies.

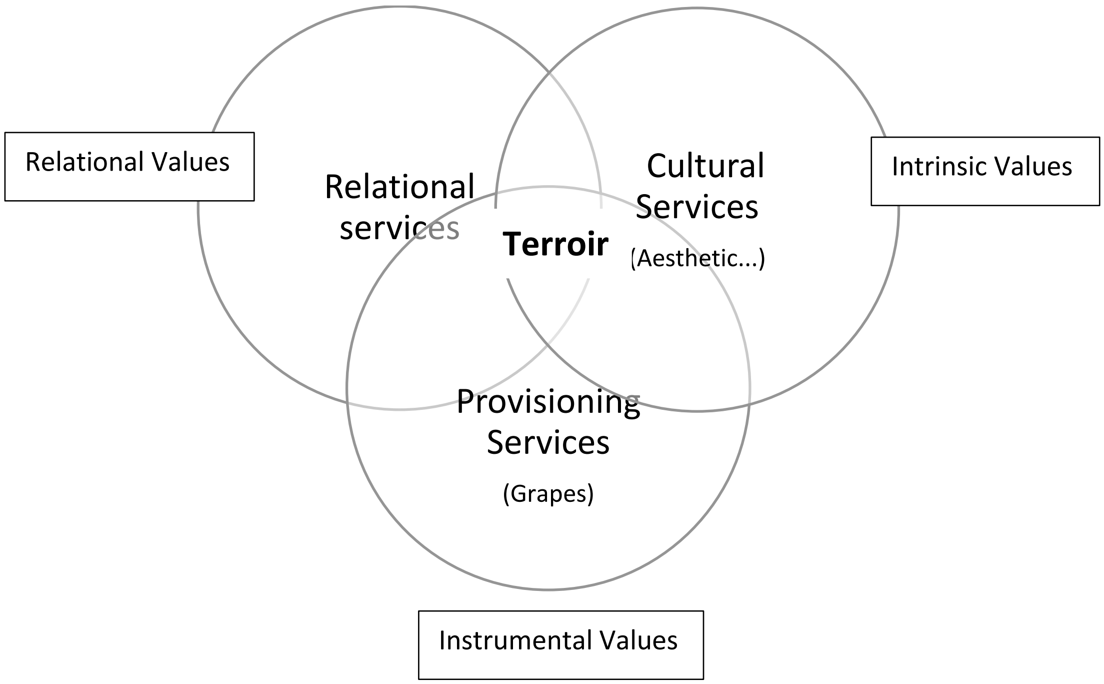

Figure 11. Conceptual illustration of ES in relation to ES framework

Our results revealed that terroir includes two distinct components - TC and TP - and stakeholders engaged with them in different ways. TC was at the intersection of CES, relational values, and provisioning services; for instance, significant associations between wine tasting, aesthetic value, social relation, and TC were found in the marketers' sub model (Figure S2c in the appendix). This represents the experience of consuming wine with family and friends in a beautiful place where the wine was produced. However, TP was associated in our dataset with ON only. The different stage of the maturity of these wine regions may affect the way they are conveying terroir dimensions. For instance, because the Niagara region is well-established. It may thus focus more on the production aspect of the wines. However, NS is an emerging wine region and needs to show their product being enjoyed.

Stakeholders in either place were not necessarily associated with TP in the clustering but there are indications of advertising being done around TP. For instance, we found that the terroir dimensions of sense of place were mentioned more by industry insiders than visitors. This is a common type of marketing strategy based on terroir to attract visitors and sell products in travel destinations (Charters & Spielmann, 2014; Marlowe & Lee, 2018). Using the terroir concept through local products, marketers try to transfer the sense of belonging of the residents to visitors

(Marlowe & Lee, 2018). This finding aligns with research stating that today the aesthetic and experiental aspects of wine tourism images are more highlighted rather than production aspects, as was the case in earlier wine tourism practices (Williams, 2001).

2.5.2. NS AND ON EXPERIENCE AND PORTRAYAL OF WINE REGIONS

Despite the fact that recreation and ecotourism value were not significantly associated with any particular region in general, their prevalence in both regions indicated that ecotourism and recreation services were an integral part of wine regions. Tourism is the most frequent subcategory of ecotourism and recreation coded, displaying no specific preference for a specific type of tourism, underlining that tourism was associated with the wine industry as well as other tourism-related settings in the region. After tourism, wine tasting was the most frequently subcategory of ecotourism and recreation. These two findings were in line with findings from another study indicating that wine tours and wine tasting were the most important motivations of tourists (Cohen & Ben-Nun, 2009), which explains why we also see that linkage particularly among marketers seeking to attract them.

A vineyard landscape with more biophysical elements tends to have more aesthetic value based on this analysis. Our initial analysis showed that landscape users in NS more frequently captioned aesthetic values than landscape users in ON. In our cluster analysis also aesthetic value is clustered with NS (Overal cluster analysis). This can be explained by the distinct geographic differences between these regions that translate into more diverse natural motifs in the NS landscape, including mountains/hills and water bodies. Our results align with previous studies which stated that homogenous landscape is less appreciated by stakeholders than landscapes that includes mountains (Gosal & Ziv, 2020) and water bodies (Peña, Casado-Arzuaga, & Onaindia, 2015; Van Zanten, Van Berkel, Meentemeyer, Smith, Tieskens, & Verburg, 2016). Landscapes with varied topography are more visually appealing to landscape users. Compared to ON, coastal NS has a wider variety of biophysical elements, which explains why a correlation existed between aesthetic values and NS.

Visiting vineyards is a social experience. According to our data set, vineyard visits are often conducted in groups and the prevalence of social relation values as well as the presence of people in photos reveal this tendency. Social relations are maintained in vineyards' landscapes mostly by people engaging in consuming wine – when photos show wine glasses and are captioned as wine tasting – as well as physical activities, including, walking, biking, and yoga. Our findings confirm a study indicating that social relation delivery in green space is sigificantly correlated to recreational activities as well as aesthetic values (Xin, Sylvie, Luyuan, & Pieter, 2020). Such findings have implications for successful vineyard development and marketing.

Luckett vineyard in NS has a particularly effective motif of vineyard marketing. Luckett's English-style phone box is located admist the linear vines and allows visitors to make free phone calls to anywhere across Canada. The owner began his Canadian food industry career as a famously Cockney market-seller in Saint John, NB, so the phone box is connected to his personal brand and thus reads as authentic. The phone box motif also adorns some of Luckett's popular wines, for instance Phone Box Red. Despite being located in only one winery and being only one distinguishing motif, both in terms of color and also identity, many visitors captured them in their photos. This shows the successful marketing of the vineyard owners, and can be applied in future amentity-based marketing. It does not only possess a distinct appearance but also gives the visitor an added experience of socializing with those not physically present. In place-branding literature this is a successful practice since it is distinguishable (Govers, 2013) and thus can be engraved in visitors' memory.

2.5.3. STAKEHOLDER EXPERIENCE AND PORTRAYAL OF WINE REGIONS

More similarities than differences between marketers' and visitors' experience are found in our study. The frequency table (Table 4) and Figure 6 show that the stakeholders bear many similariries in displaying natural features, production features, consumption features – except for wine bottles which are more frequent among marketers – tourism, activities, and aesthetic values. Also, in the overall model, marketers and visitors are not distinct. Such findings might show a "hermeneutic circle" between projecting and organic images (Ryan, 2002, pp. 965), showing the recursiveness of marketer and visitor experiences (figure 11). Based on this idea, visitors go to a place and take a photo similar to the one they have seen previously in marketeting materials. Therefore, tourism organizations should generate their online contents consistent with tourists' generated content in order to be successful (Xiang & Gretzel, 2010), and—as evidenced by Luckett's phone box—provide ready-made focal points for such photos.

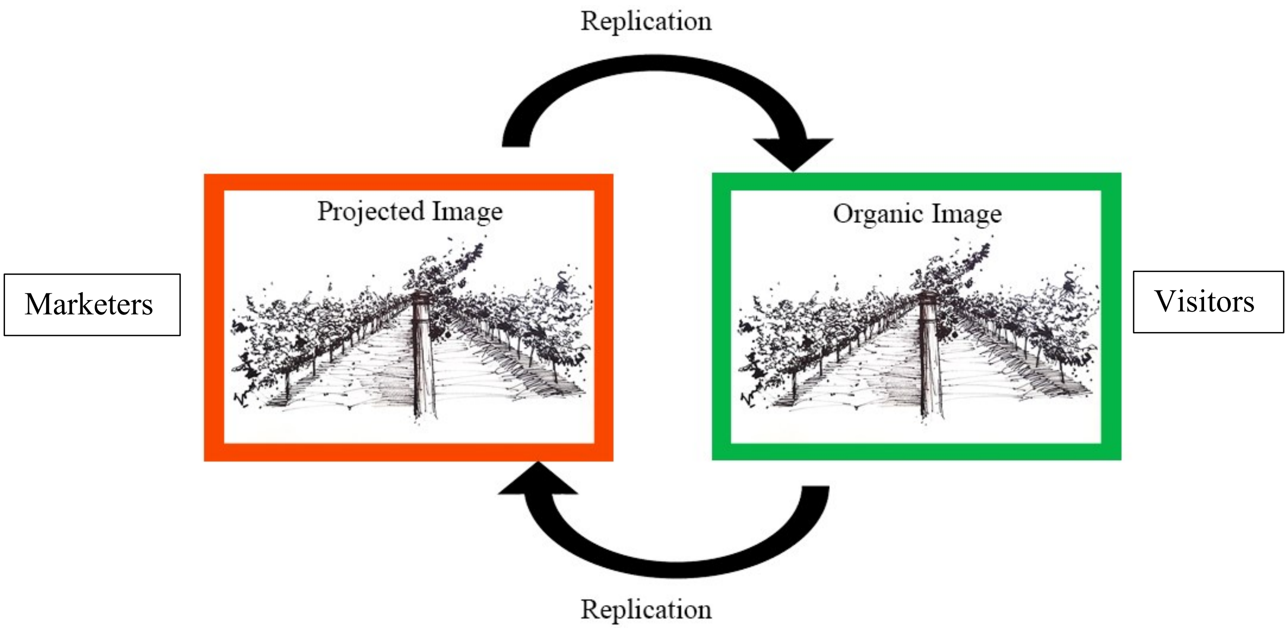

Figure 12. Conceptual illustration of “hermeneutic circle” between projected and organic images.

On the other hand, there are some differences between these groups of interests. Marketers less often highlight the man made features - including buildings, branding materials, and Canadian flag. Compared to visitors, marketers also less frequently display people and social relations. Other differences emerged showing marketers focus on events, wine tasting, TC, and TP more frequently than visitors, which are some aspects that help marketers sell the vineyard experience.

Our content analysis showed just a few consumption features in their posts. Previous studies showed that, in industry insiders’ photos – marketing materials – consumption features were frequently identified, such as wine bottles in wine regions and knives as well as glasses for liquids in food tourism regions (Gauttier, 2006 cited by Hervé et al., 2020; Hervé et al., 2020), which is not consistent with our study. In terms of CESs, Winkler & Nicholas (2016) found, using Q method, that marketers most appreciate tangible ES like production and non-marketers most appreciate intangible values of vineyard landscapes; this is not, however, confirmed in our study.

Visitors, in contrast with marketers, have a rich and varied mode of engaging with vineyards. Social relations and the presence of people are the most important differences between visitors and marketers based on the content analysis. Except for the presence of more wine bottles, events, and wine tasting values in marketer data, all the other motifs and values are either approximately the same or more frequent in visitor data. Given the fact that only Lucket vineyard has the branding material amidst the vines which are the most photographed motif, their greater presence in visitor photos reveals the success of that winery's marketing strategy. The red English "phone booth" bears a significant contrast with the surrounding landscape and the uniqueness of it attracts human eyes and thus tourists.

Tourism in man-made landscapes is appealing. It is important to take into account that linear vines are a completely man-made landscape setting which is dominates almost all photos. In addition, man-made features including buildings appeared in visitors' posts reinforced the fact that natural attractiveness was not the main reason for tourists to visit vineyards. Although it is believed that wilderness and naturalness are of importance in visiting rural areas, and considering them "beautiful," our study shows that man-made features and landscapes deliver aesthetic value. Natural resources that are not used by humans may result in declining ES production (Miyanaga & Shimada, 2018), reflecting that ecologically and economically, preserving man-made landscapes could be more valuable in some contexts. This will have implications for further rural development in wine amenity regions.

2.5.4. SOCIAL MEDIA CHALLENGES

When researchers use social media data, ethical, privacy, and copyright concerns arise, and yet there is no universal agreement on how to manage such issues (Y. Chen et al., 2021). The innovative collage approach in this study resolves some of these issues of using social media data. Collage prevents researchers from violating Instagram users' privacy by not disclosing users names and identifiable photo contents that make to convey the popularity of particular motifs, and the copyright also is protected through the delivery of a new version of visulization. However, there is still an ethical question concerning the use of such data for the purpose of research, because some researchers believe still there is a need to gain consent from users (Ravn, Barnwell, & Barbosa Neves, 2020), as they do with conventional methods. There is a need for consensus on this issue.

Despite being a promising tool, social media has some limitations. First, with a rapid change in social media content, we may expect a different result from future studies. Thus, it is important that future researchers examine similar studies with different datasets. Also, considering all the limitations embedded in Instagram data, including demographic biases (Y. Chen et al., 2018; Sherren et al., 2017), big data must not replace conventional methodology. Rather, the two methods can complement each other and be need to translate key insights (Sherren et al., 2017). In addition, we may not have included hashtags with a comprehensive representation of the data uploaded on Instagram, as some hashtags may also be created and used by certain types of users.

2.6. CONCLUSIONS

With the rapid speed of rural development for tourism activities, it is essential for decision makers to understand individuals' experiences with landscape. Among the rural areas that are attracting increasing tourists in Canada are vineyards. In this exploratory study, we sought to identify the CESs and visual motifs associated with the landscape of vineyards in ON and NS from two perspectives, vineyard marketers, and visitors.

The first contribution of this research is in the context of ES framework where we found a gap. Among CES, the category of sense of place in vineyards has different dimensions, including, terroir, sense of belonging, and award winning. Our Instagram results suggest that terroir has two diffferent dimensions, TC and TP, which remain much more important for those who are producing and marketing vineyards than those visiting them. The most frequently-mentioned CES identified in our studies are not limited to recreation and aesthetic values but also include social relation and sense of belonging dimensions neglected in many other CES studies (Cheng et al., 2019). In addition, vineyards in NS are emerging vineyards and were appreciated for aesthetic values and TC, and the presence of varied biophysical elements in NS accounts for the popularity of aesthetic values in this region. On the other hand, vineyards in ON, a well-established wine region, are characterized by TP. Thus, our findings indicated that values and motifs are context-based and may vary region to region. Despite these nuanced differences, there were a lot striking similarities in many values and visual motifs between visitors and marketers, thus supporting the recursive process of destination images. However, we also found that visitor engagement with vineyards is much more varied than that of marketers and visitors highlight the importance of social relations over terroir. Moreover, an innovative method of visualizing content from publicly accessible social media sites was employed in this study, taking into consideration the issues involving privacy as well as copyright. However, the ethical issues are yet to be solved and need more investigations.

This study has several implications for the future planning and decision-making of amenity wine regions. First, theoretically, we found that a gap exists in the ecosystem services (ES) framework around terroir. This should be considered by those working in similar amenity landscapes and be applied in similar contexts. Additionally, recursiveness of organic and projectected images provide marketers with a valuable opportunity to sell their experience as much as their wine. By simply displaying wine bottles they can market their products; however they should pay more attention to the fact that visitors portray more social relation than terroir-related motifs and values. According to this study , decision makers should not only include the voices of all stakeholders, but also research each context separately and propose context- specific scenarios for further development and planning programs. Social media can be a useful tool in tourism management practices, however, researchers should use such methods in conjunction with conventional methods in the future due to the hashag search biases and demographic biases embedded within our dataset.

2.7. ACKNOWLEDGMENTS

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CHAPTER 3: PAIRING WINE AND RENEWABLE ENERGY: A SALENCE MAPPING APPROACH TO UNDERSTANDING THE VISUAL IMPACT OF WIND AND SOLAR INFRASTRUCTURE IN CANADIAN VINEYARD LANDSCAPES

Briefly: Through an innovative method based on social media, photo editing and saliency maps, this study has shown that there is a possibility to integrate Renewable Energy (RE) into amenity vineyards' landscapes.

3.1. INTRODUCTION

Shifts toward renewable energy **(**RE) are ongoing globally to lower greenhouse gas (GHG) emissions (Panwar, Kaushik, & Kothari, 2011; Sims, 2004) and to maintain energy security. Many countries along with Canada signed the Paris Agreement to restrict the rise in global average temperature (Environment and Climate Change Canada, 2020). Working towards Paris targets, as well as energy security and diversifying sources of energy (Valentine, 2011), Canada is trying to decrease its dependence on fossil fuels and concentrate on generating energy from green sources. In Canada, electricity generation through renewable sources has increased by 18% between 2010 and 2017, with the highest increases among solar and wind energy (Natural Resources Canada, 2019). Landscapes with RE are different from the fossil fuel-powered landscapes to which many individuals are accustomed. While fossil fuel reserves are invisible and located underground, and mined, refined and used for power generation in only a few places, RE infrastructures are widely distributed above ground and thus highly visible. Decision makers typically consider rural areas to be the ideal place for setting up RE infrastructures because they possess lower real estate value in comparison with urban areas (Mccarthy, 2015), and have a higher proportion of undeveloped land (Poggi et al., 2018). Yet compared to urban areas, the visual impact of wind turbines can be more considerable in rural areas (Pedersen & Larsman, 2008). Furthermore, some rural areas are serving amenity functions and are thus destinations for different types of users. Emerging wine and grape regions, for instance, are attractive amenity landscapes for tourists and important for rural economic development in host regions (Rid et al., 2014). The experiences of such consumptive users are of consequence for rural planning and decision making (Calvert et al., 2021).

Though environmental concerns related to RE have been the subject of many studies (Dai, Bergot, Liang, Xiang, & Huang, 2015; Hernandez et al., 2014), many other concerns relate to the visual and experiential implications of RE on the landscape (Palmer, 2015; R. Xu & Wittkopf, 2015). This kind of research can be conducted through visibility analysis, focusing on computer modeling of viewsheds and avoiding areas of particular sensitivity (Alphan, 2021; Maslov, Claramunt, Wang, & Tang, 2017). Research revealed that simulations can lead to misleading information being given to the public when comparing simulated images in visual impact assessment methods with post-development photographs in an Ontario wind farm (Corry, 2011). Recent review paper comparing different types of RE in European countries found that wind turbines generate a more dramatic visual impact to landscape than solar panels (Ioannidis & Koutsoyiannis, 2020). Similar results were also obtained in Iceland (Sæþórsdóttir & Ólafsdóttir, 2020), indicating that the naturalness and wilderness of the tourist areas was diminished after wind turbine installations (Sæþórsdóttir & Ólafsdóttir, 2020). Numerous studies in the United States indicate residents' opposition to the addition of wind turbines to their amenity rural landscape (Bessette & Mills, 2021; Phadke, 2013).

Even though wind turbines can disturb landscape aesthetics in some places and no positive perceptions toward them has been found in the European context (Ioannidis & Koutsoyiannis, 2020), studies in the Czech Republic and Portugal concluded that the presence of wind turbines is not necessarily detrimental to the choice of destination for visitors (de Sousa & Kastenholz, 2015; Frantál & Kunc, 2011). Similarly, a study in the United States using focus groups showed that beachgoers expressed positive sentiments toward offshore wind farms (Smythe, Bidwell, Moore, Smith, & McCann, 2020). Another study in Spain explored brain processing to evaluate the visual impact of RE infrastructure, and found that individuals had no negative responses toward the installation of solar panels and wind turbines as part of the landscape (Grima Murcia, Sánchez Ferrer, Sorinas, Ferrandez, & Fernandez, 2017). Surprisingly, a study using global case studies (USA, Canada, United Kingdom, Iceland and Denmark) concluded that the presence of RE are actually attracting visitors in the context of industrial tourism (Beer, Rybár, & Kaľavský, 2018). One study in the United States found that hotel rooms without views of turbines are more preferred by tourists (Fooks et al., 2017), but other studies in Philippines and the United States found that tourists willingly pay more to book a room with a wind turbine view (Barrera, 2017; Fooks et al., 2017). Clearly landscape impacts of RE and tourism vary by context (Bishop, 2019), and little such work has taken place in North America yet.

Assessing public perception of RE landscapes is methodologically complex. Photographs are useful tools for such assessments (Bishop & Miller, 2007), including simulated landscape scenarios as often used in perception research (Roth, 2006; Steen Jacobsen, 2007). The accuracy of simulated photos or RE has been criticized due to the possibility of misrepresenting distance and motion, as well as the lack of representation of the real visual contrast that results (Corry, 2011; Palmer & Sullivan, 2020). Simulation techniques, including virtual reality (VR), are used to explore human perception without respondents experiencing the place in person (Cranmer et al., 2020): compared to using photo surveys without experiencing the place, respondents who saw VR were better able to assess the impact of wind turbines on their experience (Teisl, Noblet, Corey, & Giudice, 2018). User-generated photos of a landscape are not subject to such criticisms around realism since they are the evidence of visitors' experiences. Social scientists are increasingly using publicly available images on social media platforms, including Instagram, because they are a rich source of photographic evidence that allows researchers to understand human experience (Y. Chen et al., 2021). User-generated photos are valuable data to assess landscape impact in tourist attractions, because the act of taking photographs is inextricably linked to the tourist experience, but they are underutilized in RE research (Balomenou & Garrod, 2019). Researchers often assess the visual impact of a new infrastructure using photomontage techniques by the addition of the new objects to landscape (Wrózyński, Sojka, & Pyszny, 2016) or on buildings in architecture fields (R. Xu & Wittkopf, 2015; R. Xu, Wittkopf, & Roeske, 2017), but to our knowledge, assessing visual impact by removing objects from landscape is yet to be explored. Saliency maps - greyscale maps that illustrates the prominence of features within a frame – are promising yet emerging tools for such practices (Dupont et al., 2016, 2017).

This paper aims to explore the visual implications of integrating RE, such as solar panels and wind turbines, into vineyard landscapes in British Columbia and Ontario, Canada. Furthermore, this study proposes an innovative method to quantitatively assess the visual impact of RE infrastructure in such amenity landscapes that will be useful to planners and decision-makers. Through this study we aim to answer the following questions: a) How prominent or salient are nearby RE infrastructures in vineyard visitors' experiences both visually and textually? and b) how vineyard decision makers assess the potential visual impact of RE in their landscape?

3.2. ASSESSING VISUAL IMPACT

The consequences of visual impacts on tourist destinations, such as those resulting from introducing RE, should be taken into account to maintain the local benefits of that industry (Calvert et al., 2021). Palmer (2019) introduced the landscape assessment model, according to which the visual impact of a RE infrastructure is the combination of three key components: visual quality, visibility, and visual magnitude. Visual quality is a landscape's "sensitivity to changes" (Dentoni, Grosso, Massacci, & Soddu, 2020, p 8). It can be identified by its level of beauty, which influences the level of visual impact of RE infrastructures (Jiang et al., 2015) and is considered important if there are alternative settings and contexts to consider in siting (Palmer, 2019). Visibility analysis is the investigation of an object's capacity to be seen from a certain location (Kim et al., 2020), often implemented through viewshed analysis in GIS (Bishop, 2003; Klouček et al., 2015), and sometimes based on photographs (Jean-Christophe et al., 2020; Sherren et al., 2011). Finally, the distance from observers and size of a object determine its visual magnitude (Palmer, 2019) or visual prominence (Palmer & Sullivan, 2020). Using human experience documented online in our wine regions, we have the same settings, with comparable visual quality and visibility, and the only difference is the magnitute of the RE infrastructures, which varies depending on the point of view from which the photo was taken (Figure 1).

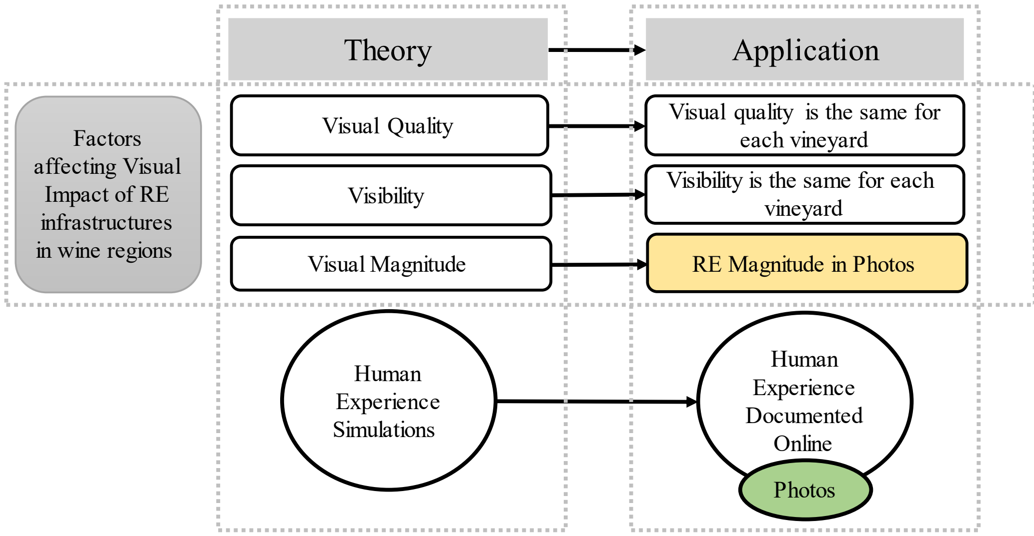


Figure 13. Wine regions visual impact assessment model

The visual quality of a setting, the visibility of RE infrastructures and visual magnitude of the facilities should be assessed when researchers simulate human experience. However, when using photos documented online the last factor needs to be assessed (adopted from J. F. Palmer, 2019).

To assess visual impacts, methods used among scholars are varied across a variety of contexts. Some researchers assess visual impact quantitatively including, for instance, a combination of 3D city models and ArcGIS in Poland (Wrózyński et al., 2016), a combination of quntitative indicators and 3D models using ArcGIS in Greece (Kokologos, Tsitoura, Kouloumpis, & Tsoutsos, 2014), an experimental study in Spain using electroencephalographic techniques to observe photo viewers'responses (Grima Murcia et al., 2017), and a GIS-based model of a proposed trasmission line using key observation points in the USA (Palmer, 2019). Social methods have also been used in some research, such as questionnaires using simulations to identify the predictors of visual impacts of wind farms on the north coast of Wales (Bishop & Miller, 2007), in-depth interviews to understand residents' opinions regarding offshore wind farms in Sweden (Waldo, 2012), and photo-based surveys to understand the visual quality and contributing factors affecting people's responses to wind turbines in the Czech Republic (Molnarova et al., 2012). Recent research has increasingly utilized social media coding instead of more conventional qualitative methods (Y. Chen et al., 2020, 2019), which has potential for understanding public attitudes and experiences in the face of landscape change (Sherren et al., 2017). Containing photos alongside textual captions, platforms including Facebook, Instagram, and Flicker, can serve as useful sources of information for researchers of landscape.

More recently, studies have shown that saliency maps can be a useful tool for visual impact assessment through photographs (Dupont et al., 2016). Saliency means the quality of being salient and according to Longman Dictionary “the salient points or features of something are the most important or most noticeable parts of it” (Salient|Meaning of Salient in Longman Dictionary of Contemporary English | LDOCE, n.d.). Saliency maps are an illustration of the likelihood that a given point is noticeable within the human eyes (R. Xu & Wittkopf, 2015), thus are a promising tool to predict human eye movements (Dupont et al., 2016) and what attracts their attention. Color, intensity, and orientation of an object relative to its surroundings determine its saliency value (Itti, Koch, & Niebur, 1998), calculated and assigned to each of the pixels in the map. This value can range from 0 to 255 on a grey-scale saliency map, with a higher value representing a more salient area. Saliency maps are used for many different scenarios, including assessing photo quality (Mai, Le, Niu, & Liu, 2011), detecting abnormal behavior in humans (Li, Li, & Ding, 2021), detecting schizophrenia disorders (Polec et al., 2019), detecting faces at a distance (El-Barkouky, Rara, Farag, & Womble, 2012), as well as the visual impact assessment of RE facilities on buildings (R. Xu & Wittkopf, 2015; R. Xu et al., 2017). However, no empirical study has been conducted to assess the visual impact of landscape changes, even though researchers have proven its validity in the landscape field (Dupont et al., 2016, 2017). Saliency maps are effective in RE planning in landscapes because they consider the contrast of RE facilities with their surroundings, which is an important factor in determinging the level of visual impact (Bishop & Miller, 2007).

Our study does not analyze visual impact as an aggregate of the visibility, quality and magnitude, as outlined by Palmer (2019), but examines only the magnitude of the RE infrastructures from user-generated photographs posted on social media. This simplifies the process of visual impact assessment for researchers considering alternatives. In the final step of decision making, this approach can be applied to evaluating the visual impact of proposed projects, as the assessment should consider multiple perspectives from which to view the project as well as capture photos from points that people will actually see in real life. (Dupont et al., 2016). The vineyard areas we study each have RE infrastructure visible in them. The landscape context and likely quality is different in the two cases (chapter 2), but this is not a concern, because we compare each captured experience to itself without the infrastructure, using photo-editing and saliency mapping.

3.3. METHODS

The study examined the prominence of RE infrastructures in wine regions adopting a mixed method approach, combining qualitative data analysis (content analysis with text) and quantitative analysis (saliency analysis with photos). In the following sections, we elaborate on details regarding the methodology.

3.3.1. STUDY AREA

Canada is working to decrease its dependency on fossil fuels concentrating on diverse green sources including wind and solar electricity. However, RE infrastructure is heterogeneously distributed across the country. Ontario (ON) developed wind and solar energy very quickly, having the highest number of wind turbines in Canada (Sherren, Parkins, Owen, & Terashima, 2019; Renewable Energy Facts, 2020) leading to weak support for the technologies in that province (Sherren et al., 2019). British Columbia (BC) generates nearly 95% of its electricity from renewable sources (Canada's Renewable Power Landscape 2016 – Energy Market Analysis, 2021), most of which is hydroelectricity.

Apart from transitions to RE, ON and BC are well-established in wine production and thus attractive tourist destinations. ON and BC have the most prominent wine regions in Canada, and their wine industries contribute to the economy of the provinces in many ways, including tourism, wine-related jobs, wine sales, grape production, tax revenue, etc. (Rimerman & Eyler, 2017). ON and BC also produce the most expensive Canadian wines, respectively (Rimerman & Eyler, 2017).

Both regions are important for their wine industries and RE transitions and we have sampled vineyards from each, including Oak Bay Estate and Dark Horse wineries. Despite having several wine regions, the Okanagan Valley, where Oak Bay Estate is located, is one of the oldest wine regions in BC and also in Canada, which is well-known for its wine and rural aesthetics (Dougherty, 2012). However, the Huron Shores wine region, where Dark Horse is located, is an emerging wine region and not as popular as the other wine regions in ON (Emerging Regions, 2021). On the roof of the Oak Bay winery are solar panels installed in 2016 and near the Dark

Horse is blue water wind project site with the capacity of 60 MW built in 2014 (Canadian Renewable Energy Project Map, n.d.).

3.3.2. DATA COLLECTION, FILTERING AND CODING FOR SENTIMENT

Vineyards where RE was likely to be visible were identified through exploration of RE-related keywords in Instagram in preparation for another study (chapter 2). This way we identified the wind farm near Dark House Estate winery (ON) and solar panels at the St Hubertus Oak Bay Estate (BC). Then using Instagram Scraper tool, a Python command line tool (GitHub - Arc298/Instagram-Scraper: Scrapes an Instagram User's Photos and Videos, n.d.-b), we gathered all the posts and associated contents ever geo-tagged in those two vineyards up until November-2020, producing 2628 posts and 1169 posts, respectively (Figure 14). Subsequently, the data was manually filtered to find those with RE infrastructure in the posted photos, removing those containing videos or without RE. Finally, we made PDF versions of each post (56 posts in ON and 38 posts in BC) and imported them into NVivo 12 to code any mentions of RE infrastructures and related sentiments towards them. The small proportion (2-3%) of all the vineyard photos that have RE visible is surprising and dealt with in the discussion.

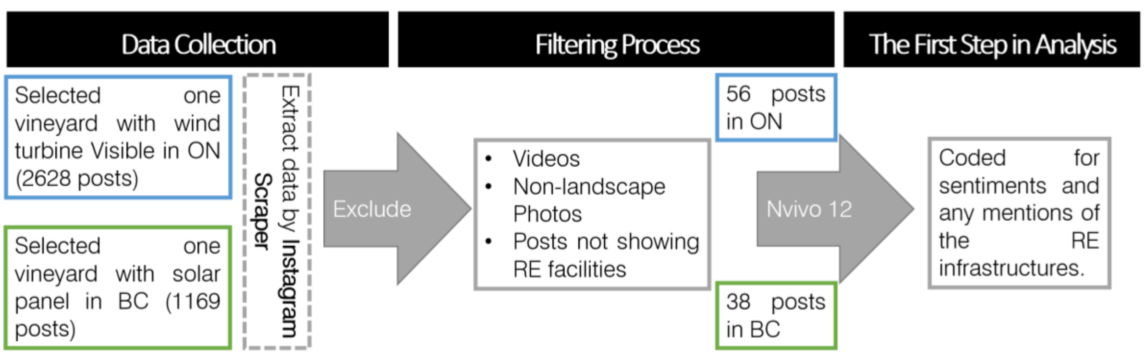


Figure 14. The process of data collection, filtering, and coding.

3.3.3. DATA SIMULATION AND SALIENCY ANALYSIS

To assess the visual impact of RE facilities, we adopted a before-after comparison technique, which is often carried out for proposed RE projects (e.g. Xu & Wittkopf, 2015). However, we conducted this by removing infrastructure in the posted images using Adobe Photoshop 21.2.3 (Figure 15), testing each version using saliency mapping. MATLAB was used to produce a saliency map using the GBVS (Graph-based Visual Saliency) algorithm (Harel, Koch,

& Perona, 2006) as used in a previous study (Dupont et al., 2016) for each original image (S1) and the associated simulation created using Photoshop (S2). The MATLAB output comprises multiple photos (resolution of 469*358=167,902 pixels, cropped manually to the most relevant areas). To compare the visual impact of RE facilities within each frame, all the original photos, associated simulations, GBVS S1s and S2s were imported to ArcGIS Pro 2.5.0. Then, using the Raster Calculator tool in ArcGIS Pro the subtraction of S2 and S1 was calculated (delta saliency map). The outlines of each RE facility were each digitized into a separate polygon layer and the Extract by Mask tool used to excerpt only the area within the RE polygons. This allowed the mean delta saliency of the area occupied by RE infrastructure to be calculated for each photo, as well as the footprint of the infrastructure itself in the photo. A negative delta saliency value means that the area of the RE is more salient before the infrastructure is removed, a positive one means that area of the photograph is more salient after it is removed. delta saliency calculations other than zero do not necessarily imply that a difference in prominence equals a negative or positive impact on saliency from the change, however: this is what the qualitative coding is for. For instance, from the example in Figure 3 the removal of wind turbines creates a significant decrease in salience of those areas of the photo, and in this case it is likely that the photo would not have been taken without the turbines. This photo was posted by the vineyard itself, but generally, a large negative value of delta saliency implies that the infrastructure was readily visible, and the photo was still taken; if there is no negative comment about the infrastructure in the caption, an ambivalence to it can be assumed. A positive value suggests the area is more eye-catching after the infrastructure is removed, suggesting it may have been hampering the photograph aesthetics. Captions can thus also help us in interpretation.

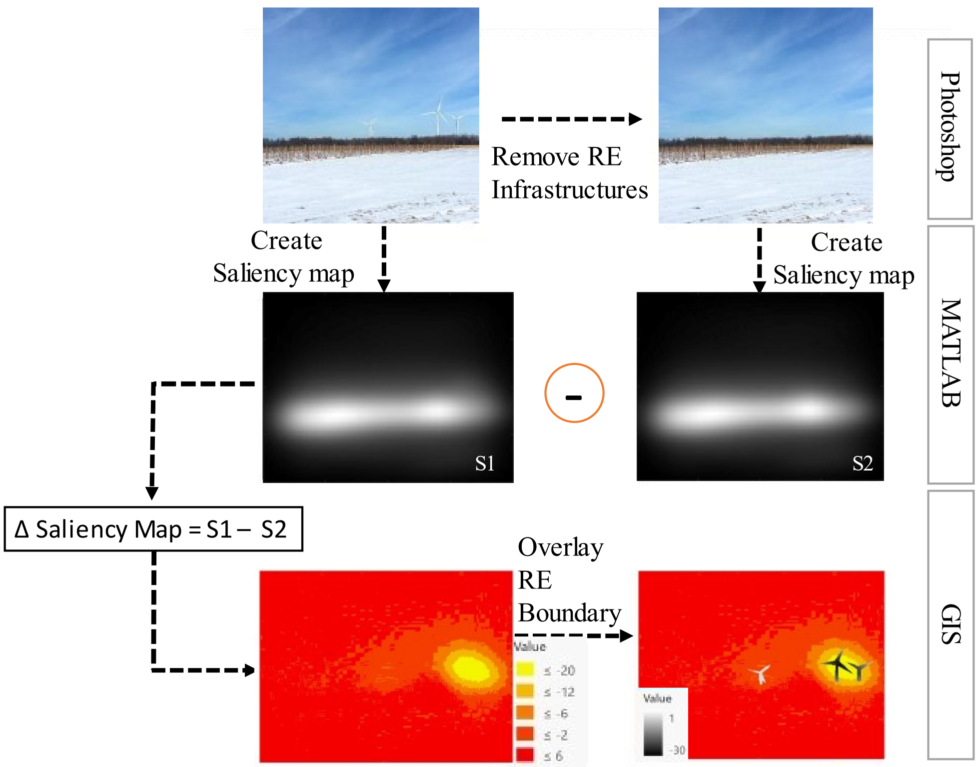


Figure 15. Flowchart displaying the process of analysis.

Original photo is displaying the Dark Horse Estate Winery (Dark Horse Estate Winery Inc., 2018, used with permission).

3.4. RESULTS

In total, we analyzed 94 Instagram posts. The small sample size of this study is not uncommon in social media research (Y. Chen et al., 2020), and was because of the fact that RE infrastructures did not often appear in Instagram posts of vineyard landscapes, even where there were RE nearby. This may or may not be intentional. Where RE was captured, it was not always very large. In the ON vineyard, only 2.1 % of the posts captured wind turbines in their photos and among those with RE only four visitors mentioned the infrastructure: three users neutrally mentioned it and one user mentioned it as a positive part of their experience. For example, caption excerpt from one photographer snapped the bride and groom amidst linear vines says:

"Had so much fun hanging out in the vines with these two last weekend. Also, how cool are windmills (CARLYN | LENNY + HUME, 2019)*."*

In the BC vineyard, 3.3 % of the posts displayed solar panels within the frame, and only two positive mentions of infrastructures identified, both mentioned by the vineyard operator. For instance, excerpt from one post caption says:

"#balance our need for power between #albertaoil (Tractors ec) and at the same time investing into local #solar (St Hubertus & Oak Bay Winery, 2019b)*."*

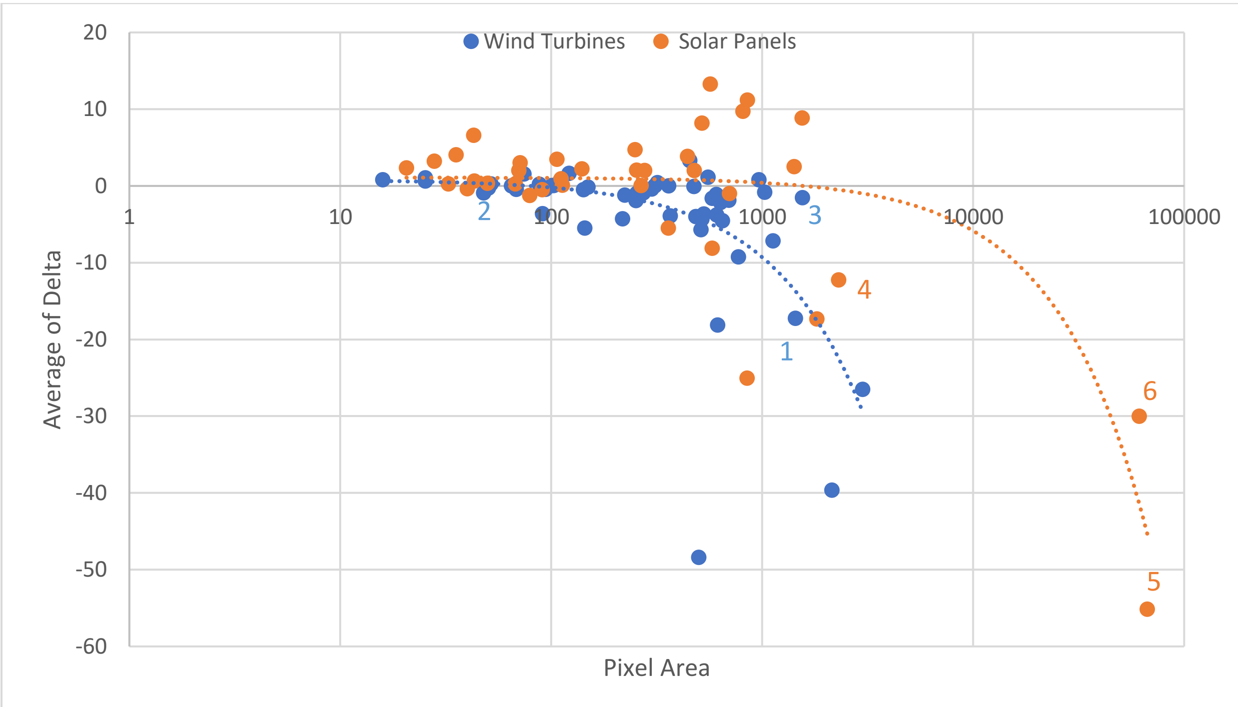
The other caption excerpt is:

"Hours away to flip the switch on our third #solarpower #sustainable #harnessingthesun ... #inharmonywithnature #renewablepower #investingintothefuture (St Hubertus & Oak Bay Winery, 2019a)*."*

Among all mentions of the RE, no negative sentiment was voiced towards either solar panels or wind turbines. While there were very few mentions of RE facilities, it is worth noting that where there was, visitors did it in the ON case and the vineyard Instagram account itself in the BC case. Perhaps this is because the vineyard owner in ON had no involvement in deciding whether to build a wind farm (we are not aware if this is the case), but the owner in BC decided on their own to install panels on their roof and it is a point of pride and market differentiation.

Looking at the footprint of infrastructure in the photos, each comprising 167,902 pixels, wind turbines occupied 1.8% of the frame at most (range 16 to 2996 pixels) and solar panels 40% or less (21 to 66879 pixels). Although solar panels comprised, on average, more pixels than wind turbines, there were two outliers displaying the vineyard from a rooftop view that significantly raise the mean value. In these two cases of 40% , the photos were posted by the vineyard owner to promote their clean energy generation. Removing those two decreased the maximum to 2300 (1.36% of the frame) and the average to 436.2 pixels. Overall, by removing outliers, less than 2% of the photo areas are occupied by the infrastructure, suggesting that they were not the main focus of the photos posted.

Plotting delta saliency against the area that RE comprises in each photo (Figure 16) shows that the RE has to be quite large in an image for its removal to have a substantial impact on saliency in the region it occupies. For instance, when wind turbines comprised fewer than 1,000 pixels of the frame, removal involved no or little difference in visual impact as estimated using saliency mapping. Two-thirds (66%) of the wind images had negative delta saliency, though most of those were only small values; only 9% overall had values outside a +/- 10 (-17.3 to -48.4). Almost a quarter (23%) of wind images had positive delta saliency, but all were very small values (0.01 to 3.3).This indicates that despite the size of wind turbines, they are not being considered conspicuous unless they are very large, perhaps because their colour allows them to blend into the sky; removal of these large ones has a negative impact on the prominence of that portion of the images.



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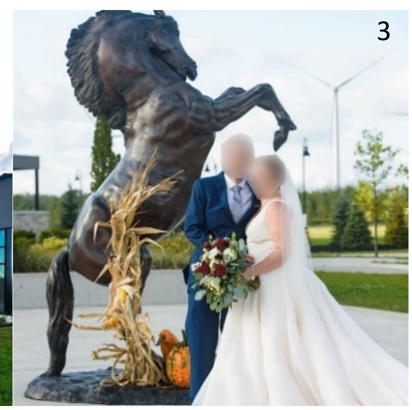

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Figure 16. Scatter plot displaying the relationship between RE area and average of delta saliency maps.

1) Dark Horse Estate Winery (Dark Horse Estate Winery Inc.,2018), 2) Dark Horse Estate Winery (Dark Horse Estate Winery Inc.,2020), 3) Dark Horse Estate Winery (Sandra Regier Photographer, 2019), 4) St Hubertus & Oak Bay Winery (Shawn Kearns, 2019), 5) St Hubertus & Oak Bay Winery (St Hubertus & Oak Bay Winery, 2019a), and 6) St Hubertus & Oak Bay Winery (St Hubertus & Oak Bay Winery, 2019b), all used with permission

Solar panels were even less impactful than wind turbines, given their location flat on the vineyard roof (Figure 3). To achieve the same visual impact as wind turbines, a solar panel had to be 10,000 pixels in size, 10 times more than wind turbines. By contrast with wind turbines, two-thirds of the solar panel pictures (68%) had positive value ranges , but only 5% were above 10 (11.2 to 13.3). Almost a third (32%) had negative value ranges, but only 13% were beyond -10 (-12.3 to -55.2). The presence of both positive and negative visual impacts of the same set of solar panels indicates photo composition and vantage point is important. For instance, the reflective nature of the panels can reflect sky and even blend into the sky, depending on the camera view. When the solar panels are large in the frame, removing them does negatively impact the prominence of the roof section involved.

Overall, to understand the visual impact of RE facilities in this study, we measured the change in magnitude of the RE facilities within the frame based on Palmer's (2019) model. In most cases there was not much difference in visual impact below 1000 pixels and below 10,000 pixels in wind energy and solar enegy infrastructure, respectively. In very rare cases, RE facilities make a big impact on the saliency. In the case of wind turbines this big impact tended to be negative, meaning removing them decreased the saliency of the area, while in the case of solar panels, there was a possibility that the significant impact is either positive or negative, depending on the composition.

3.5. DISCUSSION

The goal of this paper was to explore the visual ramifications of incorporating RE sources such as solar panels and wind turbines into vineyard landscapes in British Columbia and Ontario. We also piloted a new method for quantifying the visual impact of RE infrastructure in landscapes, which will serve as a useful tool for planners and decision-makers. We identified vineyards with RE infrastructure and selected Instagram photos showing that infrastructure. By editing out the infrastructure, we could compare understand their level of prominence within the frame using a saliency map approach. We also used associated captions to understand people's sentiment toward RE facilities, which helps to triangulate the overall message given the ambiguity of saliency measures, though there were very few cases of visitors mentioning the infrastructure.

We found that RE was rarely mentioned in captions when it was in frame, but of those rare cases there was no negative sentiment expressed toward the presence of the RE infrastructure in these two vineyard landscapes. The facilities were either neutrally or positively mentioned by ON vineyard visitors. However, in the case of solar panels, only vineyard owners mentioned RE infrastructures, indicating that visitors did not even notice them. In addition, based on the results of the saliency approach, RE facilities in the vineyard landscape in ON and BC were rarely visually prominent in the experience of vineyard visitors and thus possibly had little visual impact on landscape. However, there were rare instances of significant visual impact of RE facilities. Textually, in ON, RE were rarely prominent but were nonexistent in the case of BC. Removing the infrastructures in a few cases, in the case of wind turbines, decreases the level of saliency while solar panels both increase and decrease the level of saliency, depending on the camera view and context.

3.5.1. WIND TURBINES AND SOLAR PANELS VISUAL IMPACT

Analysis of textual data associated with Instagram photos showed rare instances of RE mentions. Among them, there was no negative sentiment toward RE infrastructures, and people mentioned RE either positively or neutrally. This is surprising, because in the ON region, fast and widespread development of RE has led to a number of oppositional reactions towards RE facilities (Fast et al., 2016; Sherren et al., 2019). However, our finding is consistent with another study conducted in a Portuguese village, showing that most tourists and residents view RE positively rather than negatively (de Sousa & Kastenholz, 2015). The rare instances of mentions highlight the need for future research, however, particularly to understand whether such infrastructure is being intentionally avoided by visitors (more on this later), especially given the small proportion of posted images from each site that actually features RE. Researchers should investigate this through primary data collections, including interviews and surveys, potentially using photos edited as we have done here.

According to the saliency analysis, in the most cases of wind energy in vineyards, there were no or little differences in visual impact below 1000 pixels. What differences exist tended to be negative, indicating that the wind turbines are visually salient, and in rare cases (above 1000 pixels), wind turbines make a big impact on the saliency of those regions of the photograph. Some of these rare cases had some unique characteristics, such as the pink sky and sunset in one, which made the wind turbines dark, perhaps affecting their contrast and thus causing high level of saliency. Also, in three cases, the wind turbines were very close to the observers and/or the view was very flat without having any other distinguishing features. With the same distance of wind turbines (but not very close), however, photos with lots of other noticeable features – like trees, lights, cars, parking lots, roads, buildings – were not as affected by the turbines. This is in line with a recent study indicationg that the presence of existing man-made elements in a landscape can positively affect people's preference for integrating RE (Spielhofer, Hunziker, Kienast, Wissen Hayek, & Grêt-Regamey, 2021), because they might cause less visual disturbance. Thus, in complex landscapes, for instance landscapes with several noticable features, wind turbines can be more easily established. Based on our results, the wind turbines in very close proximity to vineyards or being installed massively even in the distance increase the visual impact on landscapes, since the number of pixels can also increase by the number or the size of infrastructures. This is in line with another study in Switzerland, indicating that there was a significant preference for low amount of RE over high amounts in landscapes (Spielhofer et al., 2021), even though our data did not allow us to generally understand human preferences and if their sentiment toward the RE facilities is either positive or negative.

In the BC vineyard, below 10,000 pixels (approximately 6% of the photo frame) solar panels had little impact on the delta saliency result. In rare cases, the impacts were noticable but could be either positive or negative; this indicates that though the presence of solar panels in vineyards experiences can be distracting, they can also be subtle, possibly since, in some cases, they blend in the environment much better than the mere roof itself (e.g. reflecting the sky). The greater reflectiveness of solar panels is not necessarily correlated with higher visual impact (R. Xu et al., 2017). A solar panel looks black or dark blue from a distance, but when viewed at an angle, it appears pale (Grima Murcia et al., 2017). In our study the most significant negative impacts were found from the roof top when panels appeared dark blue and very close to the observers, which is not the perspective of a typical visitor. However, in positive delta saliency cases, solar panels appeared black, but the positive delta saliency was based on the background and surroundings, for instance when mountains in the background also appeared black, and the panels seemed to have no contrast with them, meaning that maintaining the panels can actually reduce the level of saliency of the panels in the image. The landscape settings and features thus have an effect on the visual impact of changes that RE introduces to landscapes, which has consequences for planners. Furthermore, depending on the position of the panels and the time of day, the color and reflectivity of the panels will vary (Grima Murcia et al., 2017), in our case even though the position of solar panels are fixed, visitors captured photographs from different locations and during different times of the day which affects how solar panels appear in the photos, and thus the visual saliency result. Further research controlling for such variables is needed to understand these compositional dynamics better. In the case of wind turbines, however, there is no reflection and thus no changes in color by changing the view points in a flat landscape like ON, unless the sky itself changes colour. Overall, solar panels are considered to have less negative visual impact compared to wind turbines, which is consistent with previous studies indicating that the level of visibility of wind turbines are higher than solar panels (Ioannidis & Koutsoyiannis, 2020).

Our findings showed that solar panels can occupy more pixels within a frame compared to wind turbines, without making a significant visual impact. This might be because of the scale of the solar panels, especially their size; compared to wind turbines which sit alone in the middle of often-natural landscape, solar panels like those in the BC vineyard are most often fixed on the roof where their visual impact would be balanced out by the presence of buildings. Solar panels can be negatively perceived because they are identified as industrial products (Ioannidis & Koutsoyiannis, 2020), in a high contrast to natural settings, and having solar panels on the roof of winery buildings, already an industrial element, may not add a significant visual impact from the perspective of humans.

RE infrastructures can be part of the recursiveness process of the organic and projected images as discussed in chapter 2. Vineyard owners in BC highlighted their solar panels and included them in their marketing materials online. People also captured photos of the panels, but they neglected to mention them in their captions. Interestingly, one of the users that I reached out to ask for permission to use their photo stated that they had not even noticed the panels. This implies that, recalling the discussion of recursiveness of the projected and organic images (chapter 2), when marketers project a photo with RE infrastructures, it is entirely possible that it becomes natural part of the experience organcially (Figure 17), and that is why we are not seeing any mentions of RE from visitors in BC. Therefore, RE facilities in the BC region were normalized through projection. Such an idea could be leveraged by vineyard owners to proactively avoid negative responses by visitors to new RE installations.

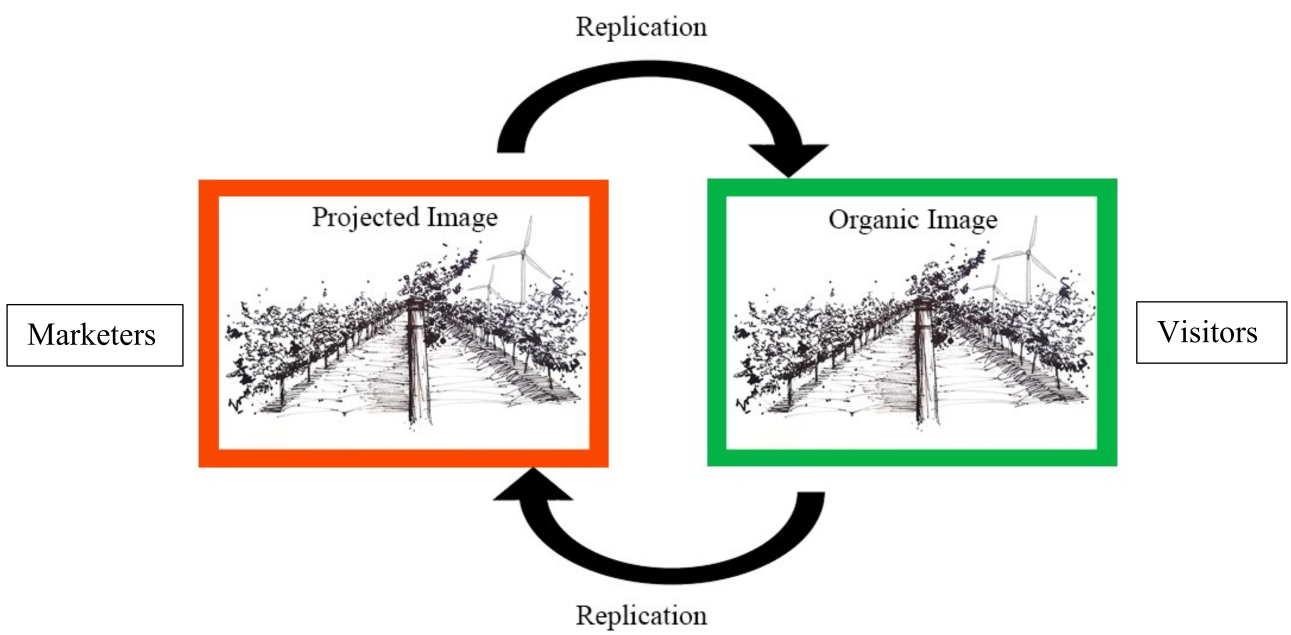

Figure 17.RE infrastructures projection and the "hermeneutic circle" between projected and organic images.

3.5.2. ANOTHER METHODOLOGICAL STEP TOWARD VISUAL IMPACT ASSESSMENT

Our method is an effective and promising tool in visual impact assessment practices for the following reasons. Visual impact of wind turbines and solar panels are among the main concerns of residents and tourists in relation to RE development (Knopper & Ollson, 2011; Rand & Hoen, 2017; R. Xu et al., 2017); this method assesses the visual impact of RE infrastructures independent of people, which reduces time and cost of research as well as subjectivity of the interpretation. For instance, simulation-based research or photo surveys require participant recruitment, but there are challenges associated with individuals opting not to participate as well as social distancing in the Covid-19 era (Patel, Doku, & Tennakoon, 2003). Methods such as photo-elicitation also can struggle with recruitment, but the interaction with researchers can also introduce bias to the resulting photographs (Orams, 2015). In addition, this approach can be used in studies where researchers need to assess both the future impact of not only the RE, but also any other changes in landscapes or on buildings, from a typical 'visitor' perspective. Researchers, consultants or decision-makers can also use the same methodology in reverse to simulate potential scenariosin a less subjective approach by adding RE infrastructures and testing the impacts on saliency from key viewpoints. Moreover, the method uses real-life experiences rather than hypothetical scenarios, so is based on actual behaviour of people rather than a prediction.

The study is not without limitations, however, or opportunities for improvement. Engagement with people (perhaps the original photographers) using these same sets of images could help validate the salience mapping and inform interpretation of the outputs (for instance, what is implied by negative or positive delta salience). Photos alone are also somewhat limited: even though they are based on real-life experiences they are static. In the case of wind turbines blade movements are excluded from the visual impact assessment using this method, although studies showed that moving blades of wind turbines do not produce as much negative visual impact as they do when stationary (Dai et al., 2015; Fergen & Jacquet, 2016). Additionally, our data was mostly collected under clear skies, because of the bias of being largely visitor-sourced, but other seasons and weather conditions should also be considered in future studies, because they may affect the visibility and contrast of RE facilities. Filters are sometimes applied to photos, but this was not taken into account in analysis process. To conduct future studies, there is a need to set a threshold for "significant" visual impacts of RE on the landscape calculated using delta salience. Finally, as mentioned above, the rarity of cases of photos capturing RE infrastructure, or mentioning it if they did, raises the debate about whether this avoidance is intentional. We can conclude with our limited dataset that RE, especially solar, is not a big risk to the visitor experience, but if most people are intentionally opting not to include it in their photos, a more nuanced story exists. To understand this better, there is a need for primary data collection in future research.

3.6. CONCLUSION

This paper presents a novel mixed method for visual impact assessment of RE infrastructures, followed by a case study examination of how the method was applied to energy vineyard landscapes in BC and ON, Canada. Our results shows that solar panels can be larger in size to have the same visual impact as wind turbines, but overall the impact is low as estimated using photo-editing and saliency mapping. In addition, vineyard users rarely mentioned the infrastructures on Instagram, even when they post photos featuring it, and RE infrastructures aren't viewed negatively when they are mentioned. The results of our study indicate that it is unlikely to be a tourism risk to integrate wind turbines and solar panels into vineyard landscapes. This research is a starting point in visual impact assessment through a social media approach and therefore has limitations that requires further investigations in future studies.

3.7. ACKNOWLEGMENT

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CHAPTER 4: CONCLUSIONS

In this research, divided into two parts, we set out to understand how vineyard landscapes are portrayed and experienced and how energy infrastructure might influence those experiences. Social media data, specifically Instagram posts including images and associated captions, were used for both parts but were given different treatments. In Chapter 2, we investigated the common visual motifs and evidence of CES delivery in two wine regions—Annapolis Valley, NS, and Niagara, Ontario—from the perspective of two different stakeholders: visitors and industry insiders we refer to as marketers. In Chapter 3, we explored the visual impact of RE infrastructures, including wind turbines and solar panels, as deployed in or near two vineyards, Dark Horse Estate winery in ON and St Hubertus Oak Bay vineyard in BC. We used a mixed method to advance visual impact assessment practices: coding Instagram data for any mentions of RE infrastructures and leveraging photo editing and saliency maps. This concluding chapter summarizes the methods, results and lessons from each in turn.

4.1. HOW ARE VINEYARD LANDSCAPES PORTRAYED AND EXPERIENCED?

In chapter 2, We gathered and filtered 200 posts associated with #nswine and #niagarawine from Instagram, evenly sampled for each stakeholder group and for each region. After filtering, data were coded in NVivo 12 deductively for CESs using the Millennium Ecosystem Assessment (Millennium Ecosystem Assessment, 2005) and inductively for visual motifs. Using RStudio 1.4.1106 platform with packages, including FactoMineR, ggplot2, and ggrepel, the underlying patterns between region, stakeholder, feature/motif and CES were identified through MCA, followed by HCA.

Our results in chapter 2 indicated that there are complex dimensions of sense of place in vineyard landscapes. Themes dominated by marketer groups including TC, TP, and award winning and are not included in the ES framework; visitors also mentioned the aforementioned themes, of which TC was the most common, but less so than for marketers. The lack of these terroir concepts in the ES framework means it cannot provide a comprehensive picture of sense of place in wine regions, indicating a theoretical gap. Relational values—when there is a mutual relationship between people and the wine regions or between people being together in the wine regions—helped us to partially fill the gap. In addition to sense of place, three other CESs were frequently identified in our study: recreation and ecotourism, aesthetic values, and social relations. Among them, social relation and sense of place have rarely been investigated in other CES research, especially CES research using social media, a lack that this work helps to remediate. ON and NS showed few differences in visual motifs and CES; for instance, marketers, more often than visitors, present events, wine tastings, TC, and TP, while social relations and man-made features were more identified in visitor experience. However, in general, this study revealed similarities in the portrayals of wine regions, reflecting that projected (those posted by marketers) and organic images (those posted by visitors) seem to undergo a recursive cycle in which each type of image reproduces the other. Moreover, we offered a new form of data visualization with the most dominant visual motif—linear vines— to avoid the complexity of using social media data, for instance copyright and privacy issues.

4.2. HOW MIGHT ENERGY INFRASTRUCTURES AFFECT THE VINEYARD EXPERIENCE?

In chapter 3 an innovative mixed method approach was introduced for assessing visual impact of RE infrastructures in vineyard landscapes, and then we examined how this method is applied with two vineyard case studies. In total, 94 Instagram posts were found from the two vineyards that included the RE infrastructure and their captions were checked for any mentions of RE. To assess the visual impact of RE facilities, a comparison was made before and after Adobe Photoshop 21.2.3 was used to remove infrastructures from the photos and MATLAB saliency maps were created to understand the areas of high visual impact in both original and modified photos. The difference (delta) in the saliency value of the area in the original photo occupied by RE infrastructure was calculated using ArcGIS Pro 2.5.0. In combination with the coding of RE mentions in captions, saliency delta values showed whether the RE infrastructure were eye-catching or otherwise provided important reasons for the photo to be taken.

Our findings in chapter 3 showed that, as estimated using photo-editing and saliency mapping, solar panels can be larger than wind turbines to have the same visual impact. However, their visual impact in both regions were not significant overall unless they were very large (i.e. close to the photographer). Similarly, there were no negative sentiments expressed towards the RE infrastructures in captions, and when they were mentioned, in rare cases, only positive or neutral comments on the presence of RE were identified.

4.4. KEY CONTRIBUTIONS

Overall, this study had several contributions, including theoretical, methodological, and in terms of application. First, based on chapter 2, terroir has been identified as a missing component of the ES framework that should be considered by those working in similar amenity landscapes. Terroir sits at the nexus of production and cultural services and relational values, and adds nuance to typical sense of place dimensions, appropriate to other international wine regions and to food tourism regions where people visit a region for the food that originates from the landscape.

Second, a new method for quantifying the visual impact of RE infrastructure in landscapes was invented. This method can serve as a useful tool for planners and decision-makers to understand the impact of possible RE siting scenarios on landscapes, either before or after construction. However, this is very experimental now, and it needs to be combined with primary data collection to be tested. Researchers should engage with the users to learn more about what it means when the saliency value is positive or negative. Although our small sample size does not provide us a representative sample, the mixed methodology used in this study proved to be an easy-to-use method which has potential for improvements in the future. By reducing the level of researcher subjectivity, costs, and time spent in typical visual impact assessment processes, this method is a useful tool to assess the visual impact of different scenarios in the face of potential landscape changes. While social media data proved to be a rich data source for this social research but generally needs primary data collection methods to complement it.

Third, the recursive nature of organic and projected images can play an important role in tourism image management. The tourism industry can benefit from knowing what people value and consider important in wine regions so they can improve visitor experiences as well as produce (i.e. project) images for marketing. For instance, to visitors social relations—being with other people—may be as important as, or more important than, terroir consumption; and visitors portrayed man-made features more frequently than marketers. Such insights should be confirmed with more conventional methods, including surveys, interviews, focus groups, etc. The fact that the vineyard landscape experience is contextual, yet quite similar among different stakeholders (i.e. recursively reproduced), can also be used by the marketers to normalize any RE infrastructures in the landscape as seems to have happened in our BC case. Most importantly, we see no evidence that the visitor experiences seem to be disturbed by the inclusion of energy infrastructure. Installing wind turbines and solar panels in wine regions are unlikely to be detrimental to tourism and could in fact be positive. Hence, the RE transformation of the case studies is characterized by creative enhancement rather than creative destruction, when multiple functions, including tourism and RE production co-exist. This is, however, different among solar panels and wind turbines, and solar panels seems to be more normalized than wind turbines. More research is needed on the nuance.

4.3. LIMITATIONS AND RECOMMENDATIONS

In addition to its implications, this study has some limitations. There are some biases associated with Instagram data and hashtag search; for instance, the creation and use of hashtags may be limited to certain types of users; also, there are demographic biases embedded in Instagram data. As noted above, primary data sources should play a complementary role in the future research. We also recognize that this study lacks the voices of residents, although we do not know whether vineyards' visitors are residents of the area or not. Additionally, this research is unable to explain why so few people are taking photographs of RE in vineyards in general. This may be intentional, and further work is really needed to understand if RE infrastructure is not visible from other vineyards, or if it is visible but being avoided by photographers, and if the latter, why. Also, in future research the saliency approach should be tested with photos by engaging the photographers of the photos to learn more about what it means when the saliency value is positive or negative. The determination of a threshold of delta saliency value is also beneficial for future researchers.

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APPENDIX A: CES CATEGORIES AND SUBCATEGORIES AND THEIR TEXTUAL AND VISUAL INDICATORS

Table S1. Coding themes and their verbal and visual indicators.

CES	Sub-Categories	Description	Textual Indicators	Visual Indicators
Recreation & tourism	Tourism	Landscapes serve an environment for tourism.	#explorenovascotia, #tourism, #discovernovascotia, #visitniagara, #winerytour, #winetravel, #visitnovascotia #canadavacations, #staycation #majicwinerybus, wine tours, #wintergetaway, explore all the estate, seasonal tours, and so on.	N/A
	Wine Tasting	Landscapes serve an environment for wine tasting.	#Winetasting, tasting, "great little tasting," wine tasting.	The presence of bikes, horse, dogs, yoga mats, brides and grooms, and screen
	Activities (Walking, dog walking, biking, yoga, horse riding, picnic, and hiking)	Landscapes serve an environment for recreational activities.	#biketour, #Winewanderlust, stroll, yoga, #picnic, hike, a good horse.	
	Events (Wedding, movie watching, and other festivals)	Landscapes serve an environment for holding events.	custom bachelorette idea, celebrating the brides to be, #winerywedding, #event, Tickets, festival, #icewinefestival, Movie nights, and so on.	

Sense of place	Terroir-Consumption	Landscapes serve local resource for food and drink.	#drinklocal, #localvore, #coolclimatewine, fantastic ice wine, #seasonedplate, #coolclimatewine, #niagarafood, #dineinthevines, and so on.	N/A
	Terroir-Production	Landscape serves an environment for grow and create products/food/drinks.	#harvest2019, "His unique Nova Scotia signature and innovative process has lead to some of the province's best sparkling wines," locally inspired food stations, showcase true maritime expression in our wines, These Traditional Method sparkling wines were crafted with grapes grown exclusively in our seaside estate vineyard in the Annapolis Valley, saline aroma that characterizes the vineyard, #viticulture, and so on.	Photographs depicting harvesting grapes or loads of grapes.
	Sense of place	Landscapes makes people feel they belong to the place.	#Valleygirl, #nslocal, #supportlocal, #Haligonian #athomeinhalifax, #novascotialife#canadasworld #eastcoastlife, #homesweethome, #home, #valleylife, #mywinecountry and so on.	N/A
	Award winning	Landscape serves an environment for people to compete and win an award.	Award winning, international (wine) superstars.	N/A
Aesthetic Value	N/A	Landscapes shows great beauty.	beautiful view, paradise calling, #beautifulnovascotia, AMAZING view, #beautifulplace #scenery, can't wine about this view,	N/A

			beautiful landscape, poetic landscape, #nofilter, stunning view, #beautifuldestinations, #raw-canada, picturesque, admire the view, and so on.	
Social Relation	N/A	Landscapes serving meeting points spot for people using them.	#famjam, Friends, Making a free phone call, festival, #dateday, Meet…, #drinkingwithfriends, with @--- and @---, Calling my family, #createcommune, , company communities and supporters, #travelingtogether, and so on.	Photographs showing a group of people (more than one person).
Educational Values	N/A	Sites serving an environment for research and study.	Classroom, #school, #learning, #fieldtrip, learning, Today's question, stories from the winemaker, article.	Photographs depicting students, researchers, or research equipment.
Inspirational Value	N/A	Landscapes inspiring art and creativity.	#winephotography, #landscapephotography, #naturephotography, #photooftheday, #picoftheday, #naturephotography, Going Hollywood and so on.	Photograph showing art that are inspired by the landscape, such as photography, painting, etc.
Spiritual & Religious	N/A	Landscapes serving an environment for spiritual and religious values.	#hiscreation	N/A

Cultural heritage value	N/A	Landscapes serving cultural and historical values.	#acadian #tradition, it was in 1978 that Jost Vineyards planted their first vines - that’s 41 years ago!	N/A

APPENDIX B: SUB-MODELS FOR LANDSCAPE STAKEHOLDERS

In this section MCA and HCA results are available for the split data. We first conducted MCA on the split data (Figure S1). Then we carried out HCA on the MCA results (Figure S2). With the data divided geographically, we identified three and four clusters in NS and ON, respectively. Within the NS dataset, the first cluster was characterized by landscape features of NS like the overall model (Figure S2a and Table S4). Cluster 2 was mainly about consuming wine in NS as portrayed by marketers (Table S5). Despite being 48% within cluster observations (lower than consuming wine related variables), marketers were clustered for the first time in our analysis, indicating the distinction of marketer groups in NS (Table S5). The last NS cluster is related to drinking wine with family and friends (Table S6). This cluster is photographed by visitors (44% Cla/Mod), focusing on the social side of the vineyard experience compared to marketers who portray consumption side to sell the experience.

Within the ON dataset (Figure S2b), the focus of the first cluster is on recreational activities with 100% and 75% of the observations associated with biking and walking, respectively (Table S29). Cluster 2 was a portrayal of aesthetic value (72.7%) of landscape features (100% water body and 83.3% field) which serve a setting for yoga activity (83.3%) (Table S28). Cluster 3 included rare observations of mountains and horse-riding variables with strong associations, but not giving us any particularly important characteristics statistically (Table S27). However, cluster 4 is characterized by wine production, indicating the maturity of ON terroir, compared with NS (Table S26). In ON, there was no significant distinction between the marketer and visitor group, perhaps indicating the recursive process of stakeholders' visuals.

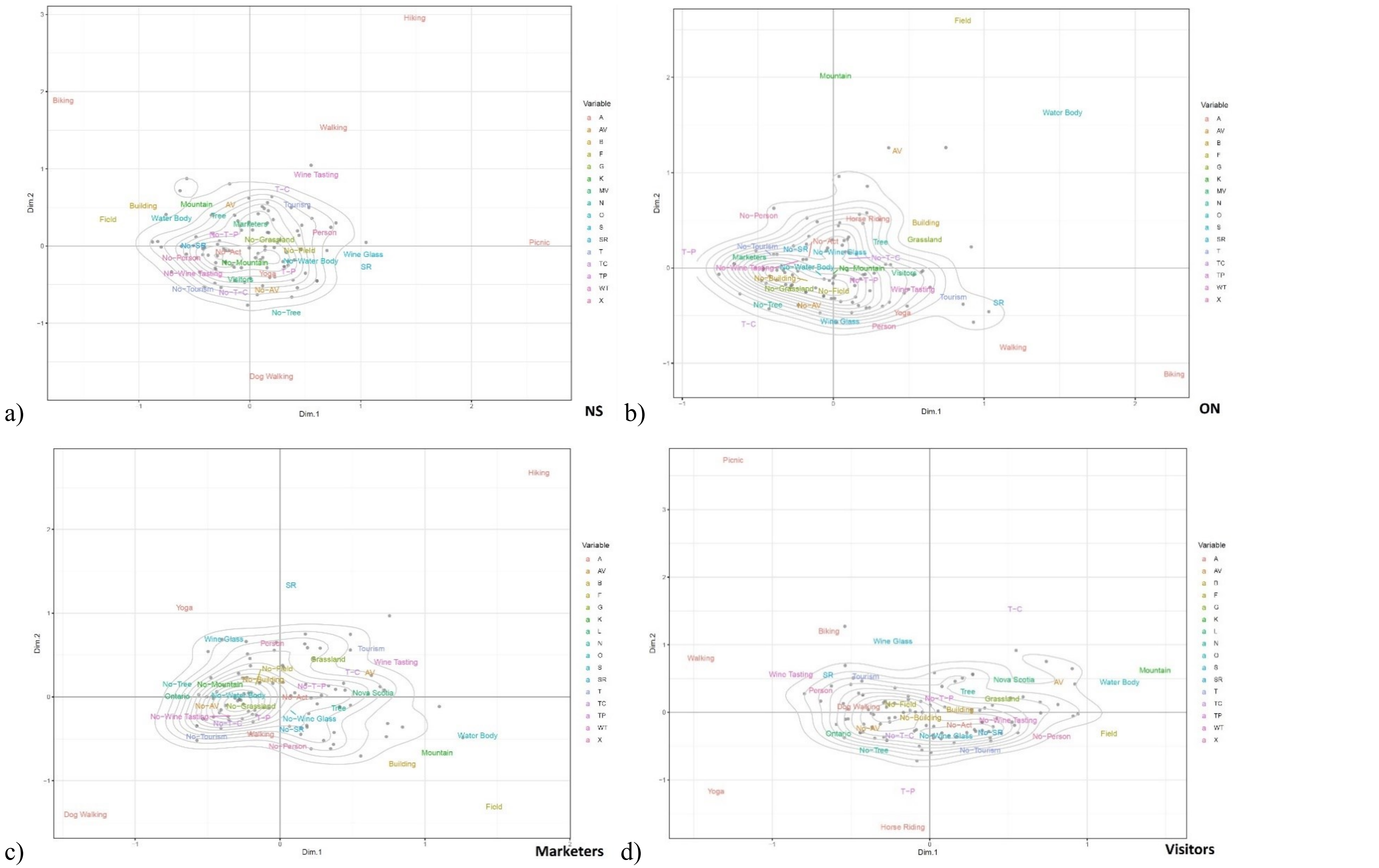


Figure S1: MCA Plots of the association between variables for a) Nova Scotia, b) Ontario, c) Marketers, and d) Visitors. (A: Activity, AV: Aesthetic value, B: Building, F: Field, G: Grassland , K: Mountain , MV: Marketers, N: Tree, O: Water Bodies, S: Wine Glass, SR: Social Relation, T: Tourism, TC: Terroir-Consumption, TP: Terroir-Production, WT: Wine-Tasting, X: Perso

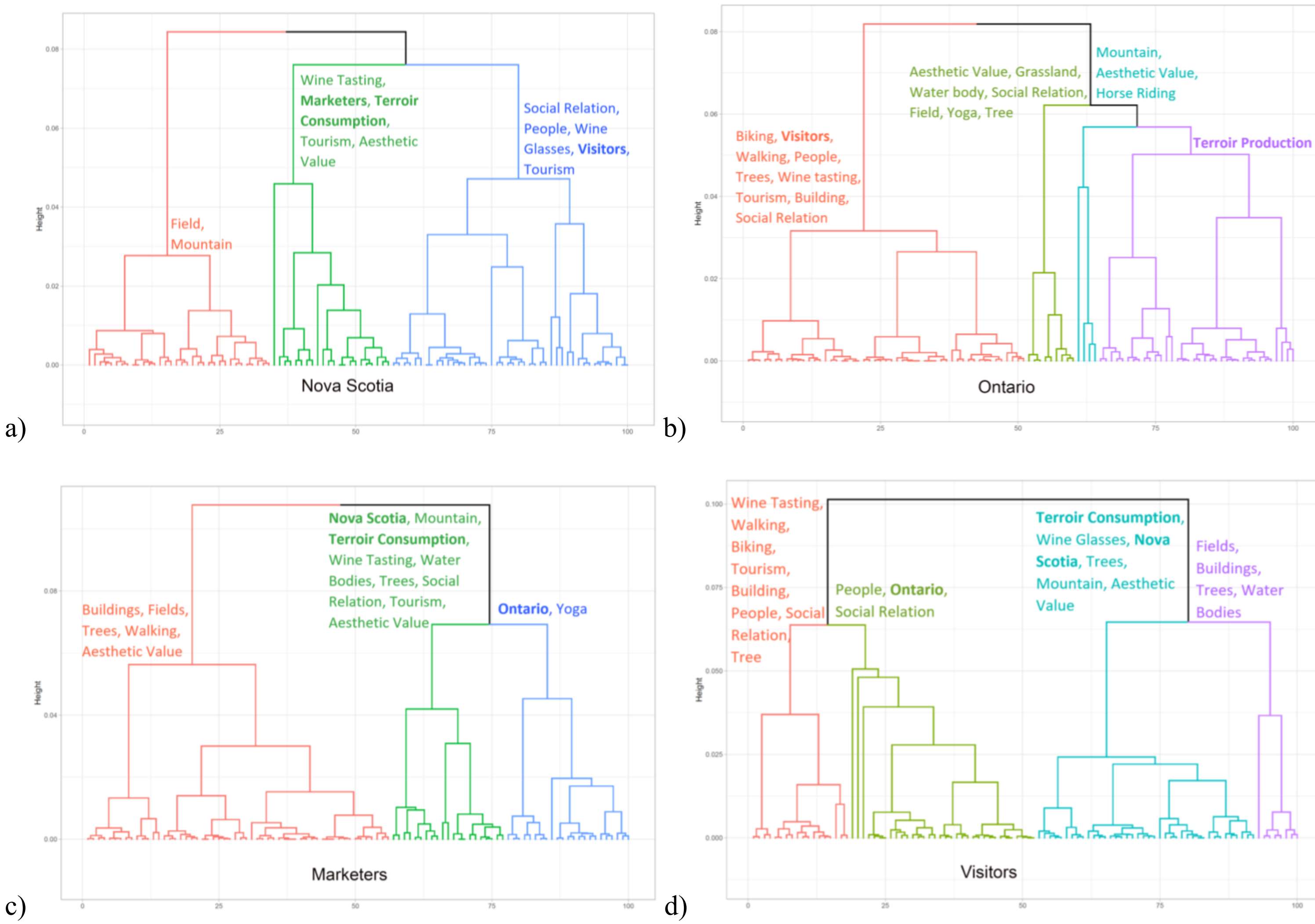


Figure S2. Clusters Dendogram of the association between variables in the case studies based on a) Nova Scotia dataset, b) Ontario dataset, c) Marketers' dataset, and d) Visitors' dataset. Note colours of clusters are randomly assigned. Bold text indicates important variables for the purposes of this paper.

After splitting the data by vineyard stakeholder type, three and four clusters were obtained within marketer and visitor datasets, respectively (Figure S2c and d). Among marketers, cluster 1 was associated with a mixture of walking activity (100% Cla/Mod but very rare global cases), fields (90% Cla/Mod), and buildings (81.25% Cla/Mod; Figure S2c), indicating man-made features are part of the important experience along with landscape (Table S12). Cluster 2 is mainly a portrayal of human interactions in NS geographic landscape, including water body and mountain (Table S13). Cluster 3 was associated with the ON region and only correlated with yoga activity (Table S14).

Among visitors, cluster 1 was mainly about the presence of landscape features and buildings (Figure S2d), similar to cluster 1 among marketers (Table S18). Cluster 2 was a portrayal of human interactions in ON (Table S17). Cluster 3 was mainly characterised by consuming wine in the NS region, despite making up only 20% of the observations (Table S16). Recreational activities were the main theme of cluster 4, similar to cluster 1 in marketers' portrayals (Table S15).

Table S2. Results of the cluster analysis showing dimensions that explain variability in the MCA results (the overall data).

Dimensions		**Eigenvalue percentage of Variance**	**Cumulative percentage of variance**
Dim 1	0.142619	10.54138	10.54138
Dim 2	0.118944	8.79148	19.33286
Dim 3	0.106096	7.841847	27.17471
Dim 4	0.07862	5.81106	32.98577
Dim 5	0.075124	5.552654	38.53842
Dim 6	0.070558	5.215173	43.7536
Dim 7	0.067525	4.990981	48.74458
Dim 8	0.064335	4.755209	53.49979
Dim 9	0.061717	4.56168	58.06147
Dim 10	0.057554	4.254012	62.31548
Dim 11	0.057021	4.214621	66.5301
Dim 12	0.054036	3.993975	70.52407
Dim 13	0.051739	3.824207	74.34828
Dim 14	0.049599	3.666037	78.01432
Dim 15	0.045968	3.397668	81.41198
Dim 16	0.04118	3.043732	84.45572
Dim 17	0.037713	2.787471	87.24319
Dim 18	0.036212	2.676569	89.91976

Dim 19	0.032721	2.418505	92.33826
Dim 20	0.028936	2.138734	94.477
Dim 21	0.027513	2.033584	96.51058
Dim 22	0.025693	1.899045	98.40962
Dim 23	0.021517	1.590375	100

Table S3. The first 8 dimensions explaining maximum variability in the MCA results (the overall data).

Dimension	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Biking	4.32E-04	4.839478	5.97E+00	1.481877	1.164898	4.388952	7.63E-02	0.390723
Dog walking	7.06E-02	0.420994	3.02E-02	0.075154	3.799692	3.963433	5.56E+01	0.118514
Hiking	2.39E-01	1.960293	1.83E+00	4.122323	7.452356	3.969187	1.53E-04	2.487757
Horse riding	2.38E-01	0.089264	3.85E-01	0.802207	18.53916	0.013322	3.91E+00	18.33498
No-Act	2.14E-01	0.509436	2.47E-01	0.56949	0.566431	0.010581	1.22E-01	0.099712
Picnic	1.98E-01	2.564032	7.17E-01	12.52014	5.708005	0.112542	7.07E-02	3.016544
Walking	4.43E-01	2.080899	2.05E+00	8.266773	1.054234	10.09218	1.16E+00	1.456674
Yoga	1.93E+00	0.005468	6.46E-04	0.970777	7.637133	2.716734	5.58E+00	38.90374
Field	1.03E+01	0.297325	6.58E+00	0.173086	1.308142	0.031416	9.07E-04	2.342701
No-Field	1.33E+00	0.038635	8.55E-01	0.022491	0.169985	0.004082	1.18E-04	0.304419
Mountain	1.28E+01	0.133672	3.18E+00	0.132605	0.152282	4.634179	9.56E-01	1.003646
No-Mountain	2.25E+00	0.023589	5.61E-01	0.023401	0.026873	0.817796	1.69E-01	0.177114
No-Water body	2.36E+00	0.02068	1.22E-02	0.006624	0.287229	1.330903	3.57E-02	0.541975
Water body	1.29E+01	0.112739	6.66E-02	0.036109	1.565861	7.255567	1.95E-01	2.954636
No-Wine glass	1.98E-01	0.656632	9.19E-01	4.314734	0.009137	0.785119	3.19E-02	0.329962

Wine glass	9.03E-01	2.991322	4.19E+00	19.65601	0.041622	3.576653	1.45E-01	1.503159
Building	3.39E+00	0.339535	1.34E+01	1.416451	1.966554	5.398647	2.61E-02	0.345888
No-Building	8.73E-01	0.087553	3.46E+00	0.365248	0.507099	1.392104	6.74E-03	0.089191
No-T-P	2.48E-02	1.306213	1.34E+00	1.852756	1.961609	1.460917	9.90E-01	2.005826
T-P	8.78E-02	4.631119	4.75E+00	6.568863	6.954796	5.179614	3.51E+00	7.111566
No-T-C	8.00E-01	1.194248	5.37E+00	0.147711	0.527692	1.450779	6.48E-04	0.041781
T-C	2.11E+00	3.148473	1.41E+01	0.38942	1.391187	3.82478	1.71E-03	0.110151
No-Wine tasting	8.77E-03	3.43979	3.31E-01	3.767251	0.371765	0.082225	4.56E-01	1.105889
Wine tasting	2.00E-02	7.838211	7.55E-01	8.584392	0.847136	0.187365	1.04E+00	2.519976
AV	6.00E+00	0.946818	4.10E-01	0.2684	9.886762	3.737045	1.06E+00	0.143774
No-AV	2.96E+00	0.466343	2.02E-01	0.132197	4.869599	1.840634	5.22E-01	0.070814
No-SR	9.17E-01	4.182986	9.24E-02	0.00273	0.244494	4.008806	2.85E-01	0.036113
SR	2.68E+00	12.22088	2.70E-01	0.007977	0.714305	11.712	8.31E-01	0.105507
Grassland	1.83E+00	0.930733	3.47E-01	0.006128	11.49212	5.639263	1.65E+00	1.435385
No-Grassland	9.65E-01	0.490233	1.83E-01	0.003228	6.053101	2.970299	8.70E-01	0.756043
No-Tourism	1.18E-01	8.66026	1.83E-01	1.769058	0.416422	0.010033	1.80E+00	1.823144
Tourism	1.53E-01	11.24838	2.38E-01	2.297742	0.54087	0.013032	2.34E+00	2.367991
No-Person	3.74E+00	7.345818	8.18E-02	0.040024	0.250206	0.237407	1.84E+00	0.110669
Person	4.13E+00	8.119062	9.04E-02	0.044238	0.276543	0.262397	2.03E+00	0.122318
No-Tree	5.66E+00	2.050812	2.17E+00	0.012164	0.732881	1.707311	3.92E+00	0.29312
Tree	3.32E+00	1.204445	1.27E+00	0.007144	0.430422	1.002706	2.30E+00	0.17215

Marketers	7.96E-02	0.897567	9.68E+00	7.812347	0.038295	0.43106	5.99E-01	2.609176
Visitors	7.96E-02	0.897567	9.68E+00	7.812347	0.038295	0.43106	5.99E-01	2.609176
Nova Scotia	6.90E+00	0.804244	1.98E+00	1.75919	0.002404	1.658937	2.64E+00	0.024047
Ontario	6.90E+00	0.804244	1.98E+00	1.75919	0.002404	1.658937	2.64E+00	0.024047

Table S4. Shows the across-cluster (Cla.Mod) and within-cluster (Mod.Cla) distributions of variables in Cluster 1 resulted from cluster analysis of the overall data.

Variables	**Cla/Mod**	**Mod/Cla**	**Global**	**p.value**	**v.test**
SR=SR	76.47059	65	25.5	4.80E-16	8.116371
X=Person	54.73684	86.66667	47.5	9.57E-14	7.446691
T=Tourism	56.32184	81.66667	43.5	6.42E-13	7.191153
WT=Wine tasting	50.81967	51.66667	30.5	3.67E-05	4.12711
K=No-Mountain	34.70588	98.33333	85	1.42E-04	3.804513
F=No-Field	33.89831	100	88.5	1.51E-04	3.790056
TP=No-T-P	35.89744	93.33333	78	3.01E-04	3.614269
MV=Visitors	40	66.66667	50	2.15E-03	3.069338
O=No-Water body	33.72781	95	84.5	4.95E-03	2.81042
S=Wine glass	50	30	18	5.76E-03	2.761412
A=Walking	83.33333	8.333333	3	1.05E-02	2.559135
S=No-Wine glass	25.60976	70	82	5.76E-03	-2.76141
O=Water body	9.677419	5	15.5	4.95E-03	-2.81042
MV=Marketers	20	33.33333	50	2.15E-03	-3.06934
A=No-Act	25.8427	76.66667	89	6.58E-04	-3.40647
TP=T-P	9.090909	6.666667	22	3.01E-04	-3.61427
F=Field	0	0	11.5	1.51E-04	-3.79006
K=Mountain	3.333333	1.666667	15	1.42E-04	-3.80451
WT=No-Wine tasting	20.86331	48.33333	69.5	3.67E-05	-4.12711
T=No-Tourism	9.734513	18.33333	56.5	6.42E-13	-7.19115
X=No-Person	7.619048	13.33333	52.5	9.57E-14	-7.44669
SR=No-SR	14.09396	35	74.5	4.80E-16	-8.11637

Table S5. Shows the across-cluster (Cla.Mod) and within-cluster (Mod.Cla) distributions of variables in Cluster 2 resulted from cluster analysis of the overall data.

Variables	Cla/Mod	Mod/Cla	Global	p.value	v.test
T=No-Tourism	65.48673	86.04651	56.5	5.39E-14	7.522046
L=Ontario	65	75.5814	50	2.30E-10	6.339704
O=No-Water body	50.29586	98.83721	84.5	1.18E-07	5.296979
N=No-Tree	63.51351	54.65116	37	8.30E-06	4.457176
SR=No-SR	51.67785	89.53488	74.5	1.49E-05	4.330733
WT=No-Wine tating	52.51799	84.88372	69.5	3.23E-05	4.156656
K=No-Mountain	48.82353	96.51163	85	3.43E-05	4.14305
TP=T-P	68.18182	34.88372	22	1.65E-04	3.766736
F=No-Field	46.89266	96.51163	88.5	1.53E-03	3.169181
G=No-Grassland	50.38168	76.74419	65.5	3.69E-03	2.903183
X=No-Person	52.38095	63.95349	52.5	5.11E-03	2.800017
AV=No-AV	49.25373	76.74419	67	1.11E-02	2.538979
TC=No-T-C	48.27586	81.39535	72.5	1.45E-02	2.443572
B=No-Building	46.54088	86.04651	79.5	4.74E-02	1.983085
B=Building	29.26829	13.95349	20.5	4.74E-02	-1.98309
TC=T-C	29.09091	18.60465	27.5	1.45E-02	-2.44357
AV=AV	30.30303	23.25581	33	1.11E-02	-2.53898
X=Person	32.63158	36.04651	47.5	5.11E-03	-2.80002
G=Grassland	28.98551	23.25581	34.5	3.69E-03	-2.90318
F=Field	13.04348	3.488372	11.5	1.53E-03	-3.16918
TP=No-T-P	35.89744	65.11628	78	1.65E-04	-3.76674
K=Mountain	10	3.488372	15	3.43E-05	-4.14305
WT=Wine tating	21.31148	15.11628	30.5	3.23E-05	-4.15666
SR=SR	17.64706	10.46512	25.5	1.49E-05	-4.33073
N=Tree	30.95238	45.34884	63	8.30E-06	-4.45718
O=Water body	3.225806	1.162791	15.5	1.18E-07	-5.29698
L=Nova Scotia	21	24.41861	50	2.30E-10	-6.3397
T=Tourism	13.7931	13.95349	43.5	5.39E-14	-7.52205

Table S6. Shows the across-cluster (Cla.Mod) and within-cluster (Mod.Cla) distributions of variables in Cluster 3 resulted from cluster analysis of the overall data.

Variables	Cla/Mod	Mod/Cla	Global	p.value	v.test

O=Water body	87.09677	50	15.5	1.66E-14	7.674504
K=Mountain	86.66667	48.14815	15	8.82E-14	7.457522
L=Nova Scotia	49	90.74074	50	2.84E-13	7.301553
F=Field	86.95652	37.03704	11.5	2.00E-10	6.361027
N=Tree	38.88889	90.74074	63	1.84E-07	5.214335
X=No-Person	40	77.77778	52.5	1.10E-05	4.396304
SR=No-SR	34.22819	94.44444	74.5	2.33E-05	4.230777
AV=AV	45.45455	55.55556	33	6.30E-05	4.0012
B=Building	46.34146	35.18519	20.5	2.92E-03	2.976281
TC=T-C	40	40.74074	27.5	1.36E-02	2.466764
A=No-Act	29.21348	96.2963	89	3.88E-02	2.065803
S=No-Wine glass	29.87805	90.74074	82	4.68E-02	1.9877
S=Wine glass	13.88889	9.259259	18	4.68E-02	-1.9877
TC=No-T-C	22.06897	59.25926	72.5	1.36E-02	-2.46676
B=No-Building	22.01258	64.81482	79.5	2.92E-03	-2.97628
AV=No-AV	17.91045	44.44444	67	6.30E-05	-4.0012
SR=SR	5.882353	5.555556	25.5	2.33E-05	-4.23078
X=Person	12.63158	22.22222	47.5	1.10E-05	-4.3963
N=No-Tree	6.756757	9.259259	37	1.84E-07	-5.21434
F=No-Field	19.20904	62.96296	88.5	2.00E-10	-6.36103
L=Ontario	5	9.259259	50	2.84E-13	-7.30155
K=No-Mountain	16.47059	51.85185	85	8.82E-14	-7.45752
O=No-Water body	15.97633	50	84.5	1.66E-14	-7.6745

Table S7. Shows the across-cluster (Cla.Mod) and within-cluster (Mod.Cla) distributions of variables in Cluster 4 resulted from cluster analysis of the overall data.

Variables	**Cla/Mod**	**Mod/Cla**	**Global**	**p.value**	**v.test**
O=Water body	87.09677	50	15.5	1.66E-14	7.674504
K=Mountain	86.66667	48.14815	15	8.82E-14	7.457522
L=Nova Scotia	49	90.74074	50	2.84E-13	7.301553
F=Field	86.95652	37.03704	11.5	2.00E-10	6.361027
N=Tree	38.88889	90.74074	63	1.84E-07	5.214335
X=No-Person	40	77.77778	52.5	1.10E-05	4.396304

SR=No-SR	34.22819	94.44444	74.5	2.33E-05	4.230777
AV=AV	45.45455	55.55556	33	6.30E-05	4.0012
B=Building	46.34146	35.18519	20.5	2.92E-03	2.976281
TC=T-C	40	40.74074	27.5	1.36E-02	2.466764
A=No-Act	29.21348	96.2963	89	3.88E-02	2.065803
S=No-Wine glass	29.87805	90.74074	82	4.68E-02	1.9877
S=Wine glass	13.88889	9.259259	18	4.68E-02	-1.9877
TC=No-T-C	22.06897	59.25926	72.5	1.36E-02	-2.46676
B=No-Building	22.01258	64.81482	79.5	2.92E-03	-2.97628
AV=No-AV	17.91045	44.44444	67	6.30E-05	-4.0012
SR=SR	5.882353	5.555556	25.5	2.33E-05	-4.23078
X=Person	12.63158	22.22222	47.5	1.10E-05	-4.3963
N=No-Tree	6.756757	9.259259	37	1.84E-07	-5.21434
F=No-Field	19.20904	62.96296	88.5	2.00E-10	-6.36103
L=Ontario	5	9.259259	50	2.84E-13	-7.30155
K=No-Mountain	16.47059	51.85185	85	8.82E-14	-7.45752
O=No-Water body	15.97633	50	84.5	1.66E-14	-7.6745

Table S8. Results of the cluster analysis showing dimensions that explain variability in the MCA results (marketers).

Dimensions		**Eigenvalue percentage of Variance**	**Cumulative percentage of variance**
Dim 1	0.168171	14.16177	14.16177
Dim 2	0.123824	10.4273	24.58908
Dim 3	0.098193	8.268923	32.858
Dim 4	0.09027	7.601662	40.45966
Dim 5	0.080402	6.770704	47.23037
Dim 6	0.073126	6.158007	53.38837
Dim 7	0.071089	5.986403	59.37478
Dim 8	0.06582	5.542742	64.91752
Dim 9	0.061582	5.185873	70.10339
Dim 10	0.056788	4.782125	74.88552
Dim 11	0.052894	4.45422	79.33974
Dim 12	0.046875	3.947391	83.28713
Dim 13	0.041239	3.472795	86.75992
Dim 14	0.035902	3.023367	89.78329
Dim 15	0.030298	2.551433	92.33472
Dim 16	0.026209	2.207105	94.54183
Dim 17	0.024834	2.091306	96.63313

Dim 18	0.0223	1.877884	98.51102
Dim 19	0.017682	1.488982	100

Table S9. The first 6 dimensions explaining maximum variability in the MCA results (marketers).

Dimension	**1**	**2**	**3**	**4**	**5**	**6**
Dog walking	7.28E-01	1.099746	0.059039	0.796641	1.70E+00	4.968459
Hiking	1.26E+00	3.823201	0.439358	1.521812	1.24E+01	1.741777
No-Act	7.29E-02	0.240402	0.882918	0.479978	5.45E-02	0.295941
Walking	2.33E-02	0.125374	2.661514	1.707596	5.13E-05	40.9891
Yoga	1.14E+00	3.004197	6.38014	18.53885	1.13E+00	1.484101
Field	8.73E+00	7.728396	6.490424	0.003042	8.74E+00	1.709142
No-Field	9.70E-01	0.858711	0.721158	0.000338	9.71E-01	0.189905
Mountain	8.22E+00	2.993422	13.44877	4.026745	1.51E-01	0.473528
No-Mountain	1.68E+00	0.613111	2.754567	0.824755	3.10E-02	0.096988
No-Water body	1.68E+00	0.379043	0.528022	0.787618	1.20E+00	0.230531
Water body	9.54E+00	2.147913	2.992124	4.463167	6.77E+00	1.306343
No-Wine glass	1.45E-01	1.027935	0.144087	1.505441	3.89E-01	1.240038
Wine glass	7.07E-01	5.018741	0.703484	7.350095	1.90E+00	6.054305
Building	4.79E+00	4.23677	13.7981	1.877553	7.72E+00	3.09454
No-Building	9.13E-01	0.807004	2.628209	0.357629	1.47E+00	0.589436
No-T-P	2.27E-01	0.903553	6.057862	1.346439	1.46E-03	9.226439
T-P	4.41E-01	1.753956	11.75938	2.613676	2.83E-03	17.91015
No-T-C	2.04E+00	1.812941	1.638359	11.43221	6.29E-01	0.008354
T-C	3.06E+00	2.719411	2.457539	17.14831	9.44E-01	0.012532
No-Wine tasting	2.75E+00	1.673647	0.484891	0.466648	2.60E+00	0.467667
Wine tasting	5.10E+00	3.108201	0.900512	0.866631	4.83E+00	0.868524
AV	6.27E+00	0.880131	3.521091	0.003186	1.36E+01	0.0322
No-AV	3.68E+00	0.516903	2.067942	0.001871	7.96E+00	0.018911
No-SR	7.63E-04	4.021534	0.269394	2.046003	1.35E+00	0.018824
SR	3.05E-03	16.08614	1.077577	8.18401	5.40E+00	0.075297
Grassland	1.76E+00	2.332408	1.1714	4.890092	1.12E+00	1.314061
No-Grassland	8.30E-01	1.097604	0.551247	2.30122	5.25E-01	0.618382
No-Tourism	4.24E+00	4.462196	1.172959	0.002172	1.33E-01	0.088895
Tourism	5.40E+00	5.679159	1.492857	0.002764	1.70E-01	0.113139
No-Person	2.17E-05	7.797576	0.138131	0.086059	6.78E+00	1.678742
Person	3.00E-05	10.76808	0.190752	0.118843	9.36E+00	2.318263
No-Tree	6.30E+00	0.146832	0.528678	0.653395	1.60E-03	0.017077
Tree	4.56E+00	0.106327	0.382835	0.473148	1.16E-03	0.012366
Nova Scotia	6.36E+00	0.014719	4.752342	1.561034	3.14E-05	0.368024
Ontario	6.36E+00	0.014719	4.752342	1.561034	3.14E-05	0.368024

Table S10. Shows the across-cluster (Cla.Mod) and within-cluster (Mod.Cla) distributions of variables in Cluster 1 resulted from cluster analysis of the marketers group.

Variables	Cla/Mod	Mod/Cla	Global	p.value	v.test
L=Ontario	88	75.86207	50	5.83E-10	6.195062
K=No-Mountain	68.6747	98.27586	83	1.53E-06	4.807431
N=No-Tree	83.33333	60.34483	42	1.07E-05	4.402433
O=No-Water body	67.05882	98.27586	85	1.29E-05	4.362118
B=No-Building	66.66667	96.55172	84	7.37E-05	3.964093
F=No-Field	64.44444	100	90	8.50E-05	3.929836
AV=No-AV	71.42857	77.58621	63	4.85E-04	3.489073
T=No-Tourism	73.21429	70.68966	56	6.02E-04	3.430775
TC=No-T-C	71.66667	74.13793	60	8.50E-04	3.335972
WT=No-Wine tasting	69.23077	77.58621	65	2.38E-03	3.037788
G=No-Grassland	66.17647	77.58621	68	1.84E-02	2.356824
A=Yoga	100	10.34483	6	3.40E-02	2.120613
G=Grassland	40.625	22.41379	32	1.84E-02	-2.35682
WT=Wine tasting	37.14286	22.41379	35	2.38E-03	-3.03779
TC=T-C	37.5	25.86207	40	8.50E-04	-3.33597
T=Tourism	38.63636	29.31035	44	6.02E-04	-3.43078
AV=AV	35.13514	22.41379	37	4.85E-04	-3.48907
F=Field	0	0	10	8.50E-05	-3.92984
B=Building	12.5	3.448276	16	7.37E-05	-3.96409
O=Water body	6.666667	1.724138	15	1.29E-05	-4.36212
N=Tree	39.65517	39.65517	58	1.07E-05	-4.40243
K=Mountain	5.882353	1.724138	17	1.53E-06	-4.80743
L=Nova Scotia	28	24.13793	50	5.83E-10	-6.19506

Table S11. Shows the across-cluster (Cla.Mod) and within-cluster (Mod.Cla) distributions of variables in Cluster 2 resulted from cluster analysis of the marketers group.

Variables	Cla/Mod	Mod/Cla	Global	p.value	v.test
L=Nova Scotia	50	96.15385	50	9.38E-09	5.741533
K=Mountain	76.47059	50	17	1.99E-06	4.754009
TC=T-C	47.5	73.07692	40	9.44E-05	3.904496

WT=Wine tasting	48.57143	65.38462	35	2.82E-04	3.63155
O=Water body	66.66667	38.46154	15	4.13E-04	3.531568
N=Tree	36.2069	80.76923	58	6.19E-03	2.737753
SR=SR	50	38.46154	20	1.09E-02	2.545052
T=Tourism	38.63636	65.38462	44	1.27E-02	2.491077
B=No-Building	29.7619	96.15385	84	4.52E-02	2.002488
AV=AV	37.83784	53.84615	37	4.58E-02	1.997345
AV=No-AV	19.04762	46.15385	63	4.58E-02	-1.99735
B=Building	6.25	3.846154	16	4.52E-02	-2.00249
T=No-Tourism	16.07143	34.61539	56	1.27E-02	-2.49108
SR=No-SR	20	61.53846	80	1.09E-02	-2.54505
N=No-Tree	11.90476	19.23077	42	6.19E-03	-2.73775
O=No-Water body	18.82353	61.53846	85	4.13E-04	-3.53157
WT=No-Wine tasting	13.84615	34.61539	65	2.82E-04	-3.63155
TC=No-T-C	11.66667	26.92308	60	9.44E-05	-3.9045
K=No-Mountain	15.66265	50	83	1.99E-06	-4.75401
L=Ontario	2	3.846154	50	9.38E-09	-5.74153

Table S12. Shows the across-cluster (Cla.Mod) and within-cluster (Mod.Cla) distributions of variables in Cluster 3 resulted from cluster analysis of the marketers group.

Variables	**Cla/Mod**	**Mod/Cla**	**Global**	**p.value**	**v.test**
B=Building	81.25	81.25	16	4.03E-11	6.603079
F=Field	90	56.25	10	5.64E-08	5.429731
N=Tree	24.13793	87.5	58	8.46E-03	2.632952
SR=No-SR	20	100	80	2.00E-02	2.325777
A=Walking	100	12.5	2	2.42E-02	2.253265
AV=AV	27.02703	62.5	37	2.84E-02	2.191931
S=No-Wine glass	19.27711	100	83	3.84E-02	2.070366
S=Wine glass	0	0	17	3.84E-02	-2.07037
AV=No-AV	9.52381	37.5	63	2.84E-02	-2.19193
SR=SR	0	0	20	2.00E-02	-2.32578
N=No-Tree	4.761905	12.5	42	8.46E-03	-2.63295
F=No-Field	7.777778	43.75	90	5.64E-08	-5.42973

B=No-Building	3.571429	18.75	84	4.03E-11	-6.60308

Table S13. Results of the cluster analysis showing dimensions that explain variability in the MCA results (visitors).

Dimensions		**Eigenvalue percentage of Variance**	**Cumulative percentage of variance**
Dim 1	0.172321	13.12923	13.12923
Dim 2	0.122075	9.300967	22.4302
Dim 3	0.11357	8.652927	31.08313
Dim 4	0.086451	6.586776	37.6699
Dim 5	0.078203	5.958293	43.6282
Dim 6	0.075115	5.723068	49.35126
Dim 7	0.071158	5.421576	54.77284
Dim 8	0.069175	5.27051	60.04335
Dim 9	0.064238	4.894302	64.93765
Dim 10	0.056921	4.3368	69.27445
Dim 11	0.054181	4.128063	73.40252
Dim 12	0.052828	4.024963	77.42748
Dim 13	0.048347	3.683547	81.11103
Dim 14	0.04282	3.2625	84.37353
Dim 15	0.039196	2.98633	87.35986
Dim 16	0.035469	2.702383	90.06224
Dim 17	0.029603	2.255437	92.31768
Dim 18	0.029236	2.227508	94.54518
Dim 19	0.027919	2.127181	96.67236
Dim 20	0.027075	2.062823	98.73519
Dim 21	0.016601	1.264813	100

Table S14. The first 7 dimensions explaining maximum variability in the MCA results (visitors).

Dimension	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Biking	0.69115	2.55E+00	10.44917	1.76E-01	0.493098	1.02E+01	2.97E+00
Dog Walking	0.058486	1.82E-06	0.065277	3.15E+01	7.416678	2.97E+00	1.15E-01
Horse Riding	0.005184	1.32E+00	0.947534	3.51E+00	13.66604	3.16E+01	1.84E-01
No-Act	0.583935	4.00E-01	0.558248	4.36E-02	0.176245	2.31E-01	3.82E-01
Picnic	0.611497	6.80E+00	1.791586	6.00E+00	15.9281	2.53E+00	5.15E-01

Walking	3.2821 54	1.05E+0 0	6.04965 4	3.30E- 01	12.5506 6	9.16E+0 0	5.79E+0 0
Yoga	0.6186 65	5.89E- 01	5.37701 2	1.18E+0 0	1.62525 6	1.75E+0 0	3.22E+0 1
Field	6.6651 64	3.25E- 01	4.44878 8	1.95E+0 0	1.38877 4	4.80E- 02	9.80E+0 0
No-Field	0.9959 44	4.86E- 02	0.66476 1	2.91E- 01	0.20751 8	7.18E- 03	1.46E+0 0
Mountain	10.350 25	3.38E+0 0	1.77089	2.48E- 02	1.19654 6	4.36E- 02	6.63E+0 0
No-Mountain	1.5465 9	5.06E- 01	0.26461 6	3.71E- 03	0.17879 4	6.52E- 03	9.91E- 01
No-Water body	1.7427 03	4.54E- 01	0.31150 9	1.72E- 02	0.08719 2	2.84E- 03	4.17E- 01
Water body	9.1491 93	2.38E+0 0	1.63542 4	9.05E- 02	0.45775 8	1.49E- 02	2.19E+0 0
No-Wine glass	0.1308 3	2.12E+0 0	2.95252 1	4.53E- 01	0.12731 9	1.20E- 01	1.27E+0 0
Wine glass	0.5577 47	9.05E+0 0	12.5870 6	1.93E+0 0	0.54277 9	5.12E- 01	5.39E+0 0
Building	0.5427 91	2.69E- 02	16.5612 3	2.57E+0 0	1.09185 7	1.33E- 01	3.44E+0 0
No-Building	0.1809 3	8.95E- 03	5.52041 1	8.56E- 01	0.36395 2	4.42E- 02	1.15E+0 0
No-T-P	0.0030 53	6.59E- 01	0.12766 3	3.19E- 01	0.76899 9	1.71E- 01	1.57E+0 0
T-P	0.0274 73	5.93E+0 0	1.14896 8	2.87E+0 0	6.92099 5	1.54E+0 0	1.41E+0 1
No-T-C	0.2320 23	2.81E+0 0	0.74217 8	3.91E- 01	0.23980 2	1.24E- 01	4.70E- 01
T-C	1.3148	1.59E+0 1	4.20567 3	2.22E+0 0	1.35887 7	7.03E- 01	2.66E+0 0
No-Wine tasting	2.2876 83	1.06E+0 0	1.67037 9	1.80E- 01	1.06994 3	2.33E- 04	8.21E- 02
Wine tasting	6.5110 99	3.00E+0 0	4.75415 6	5.11E- 01	3.04522 1	6.63E- 04	2.34E- 01
AV	6.2343 52	1.91E+0 0	0.40298 2	7.08E- 05	12.1851 5	1.58E+0 0	7.03E- 02
No-AV	2.5464 25	7.79E- 01	0.16459 8	2.89E- 05	4.97703 3	6.45E- 01	2.87E- 02
No-SR	2.4466 46	1.54E+0 0	0.63121 4	2.57E- 04	0.47709 4	1.86E+0 0	9.88E- 02
SR	5.4457 61	3.42E+0 0	1.40495 9	5.72E- 04	1.06192	4.14E+0 0	2.20E- 01

Grassland	2.245238	2.43E-01	0.996916	7.99E+00	0.134847	1.11E+01	3.45E-06
No-Grassland	1.318632	1.43E-01	0.58549	4.69E+00	0.079196	6.54E+00	2.02E-06
No-Tourism	1.493764	6.44E+00	0.358476	4.21E+00	1.906563	2.77E+00	1.83E-01
Tourism	1.980105	8.54E+00	0.475189	5.58E+00	2.527305	3.68E+00	2.43E-01
No-Person	8.930996	1.68E+00	0.465901	1.06E-01	1.323618	2.32E+00	3.66E-02
Person	7.91994	1.49E+00	0.413157	9.37E-02	1.173775	2.06E+00	3.24E-02
No-Tree	1.902318	3.61E+00	6.244284	8.92E+00	0.172751	9.93E-03	2.56E+00
Tree	0.895209	1.70E+00	2.938487	4.20E+00	0.081294	4.67E-03	1.20E+00
Nova	4.275632	4.05E+00	0.156818	3.42E+00	1.498523	6.52E-01	6.66E-01
Ontario	4.275632	4.05E+00	0.156818	3.42E+00	1.498523	6.52E-01	6.66E-01

Table S15. Shows the across-cluster (Cla.Mod) and within-cluster (Mod.Cla) distributions of variables in Cluster 1 resulted from cluster analysis of the visitors group.

Variables	**Cla/Mod**	**Mod/Cla**	**Global**	**p.value**	**v.test**
TC=T-C	60	90	15	2.49E-08	5.573806
S=Wine glass	36.84211	70	19	2.78E-04	3.635424
L=Nova Scotia	20	100	50	5.93E-04	3.434604
N=Tree	14.70588	100	68	1.68E-02	2.391133
K=Mountain	30.76923	40	13	2.68E-02	2.214194
AV=AV	20.68966	60	29	3.83E-02	2.071773
B=No-Building	13.33333	100	75	4.79E-02	1.978374
B=Building	0	0	25	4.79E-02	-1.97837
AV=No-AV	5.633803	40	71	3.83E-02	-2.07177
K=No-Mountain	6.896552	60	87	2.68E-02	-2.21419
N=No-Tree	0	0	32	1.68E-02	-2.39113
L=Ontario	0	0	50	5.93E-04	-3.4346
S=No-Wine glass	3.703704	30	81	2.78E-04	-3.63542
TC=No-T-C	1.176471	10	85	2.49E-08	-5.57381

Table S16. Shows the across-cluster (Cla.Mod) and within-cluster (Mod.Cla) distributions of variables in Cluster 2 resulted from cluster analysis of the visitors group.

Variables	Cla/Mod	Mod/Cla	Global	p.value	v.test
N=No-Tree	81.25	66.66667	32	3.49E-09	5.906643
B=No-Building	50.66667	97.4359	75	1.03E-05	4.41112
X=Person	56.60377	76.92308	53	1.31E-04	3.82368
O=No-Water body	46.42857	100	84	1.51E-04	3.789936
F=No-Field	44.82759	100	87	9.23E-04	3.312867
K=No-Mountain	43.67816	97.4359	87	1.14E-02	2.530138
AV=No-AV	46.47887	84.61539	71	1.67E-02	2.392175
L=Ontario	50	64.10256	50	2.66E-02	2.218041
TC=No-T-C	43.52941	94.8718	85	2.67E-02	2.215962
SR=SR	54.83871	43.58974	31	3.44E-02	2.11588
SR=No-SR	31.88406	56.41026	69	3.44E-02	-2.11588
TC=T-C	13.33333	5.128205	15	2.67E-02	-2.21596
L=Nova Scotia	28	35.89744	50	2.66E-02	-2.21804
AV=AV	20.68966	15.38462	29	1.67E-02	-2.39218
K=Mountain	7.692308	2.564103	13	1.14E-02	-2.53014
F=Field	0	0	13	9.23E-04	-3.31287
O=Water body	0	0	16	1.51E-04	-3.78994
X=No-Person	19.14894	23.07692	47	1.31E-04	-3.82368
B=Building	4	2.564103	25	1.03E-05	-4.41112
N=Tree	19.11765	33.33333	68	3.49E-09	-5.90664

Table S17. Shows the across-cluster (Cla.Mod) and within-cluster (Mod.Cla) distributions of variables in Cluster 3 resulted from cluster analysis of the visitors group.

Variables	Cla/Mod	Mod/Cla	Global	p.value	v.test
WT=Wine	38.46154	71.42857	26	1.62E-04	3.771603
A=Walking	100	28.57143	4	2.55E-04	3.656907
A=Biking	100	28.57143	4	2.55E-04	3.656907
T=Tourism	27.90698	85.71429	43	6.52E-04	3.409033
B=Building	36	64.28571	25	9.92E-04	3.292756
X=Person	24.5283	92.85714	53	1.00E-03	3.289469
SR=SR	32.25807	71.42857	31	1.08E-03	3.267721
N=Tree	20.58824	100	68	2.79E-03	2.990093
S=No-Wine	17.28395	100	81	4.13E-02	2.040877
S=Wine	0	0	19	4.13E-02	-2.04088

N=No-Tree	0	0	32	2.79E-03	-2.99009
SR=No-SR	5.797101	28.57143	69	1.08E-03	-3.26772
X=No-Person	2.12766	7.142857	47	1.00E-03	-3.28947
B=No-Building	6.666667	35.71429	75	9.92E-04	-3.29276
T=No-Tourism	3.508772	14.28571	57	6.52E-04	-3.40903
WT=No-Wine	5.405405	28.57143	74	1.62E-04	-3.7716
A=No-Act	6.818182	42.85714	88	6.47E-06	-4.51048

Table S18. Shows the across-cluster (Cla.Mod) and within-cluster (Mod.Cla) distributions of variables in Cluster 4 resulted from cluster analysis of the visitors group.

Variables	**Cla/Mod**	**Mod/Cla**	**Global**	**p.value**	**v.test**
X=No-Person	70.21277	89.18919	47	3.12E-11	6.640691
T=No-Tourism	56.14035	86.48649	57	3.38E-06	4.646396
SR=No-SR	50.72464	94.5946	69	8.61E-06	4.44931
F=Field	92.30769	32.43243	13	1.74E-05	4.295689
WT=No-Wine tasting	47.2973	94.5946	74	1.76E-04	3.751173
S=No-Wine glass	44.44444	97.2973	81	8.16E-04	3.347171
A=No-Act	42.04546	100	88	2.54E-03	3.018495
B=Building	60	40.54054	25	8.05E-03	2.650071
N=Tree	45.58824	83.78378	68	9.46E-03	2.594888
O=Water body	62.5	27.02703	16	2.84E-02	2.191931
O=No-Water body	32.14286	72.97297	84	2.84E-02	-2.19193
N=No-Tree	18.75	16.21622	32	9.46E-03	-2.59489
B=No-Building	29.33333	59.45946	75	8.05E-03	-2.65007
S=Wine glass	5.263158	2.702703	19	8.16E-04	-3.34717
WT=Wine tasting	7.692308	5.405405	26	1.76E-04	-3.75117
F=No-Field	28.73563	67.56757	87	1.74E-05	-4.29569
SR=SR	6.451613	5.405405	31	8.61E-06	-4.44931
T=Tourism	11.62791	13.51351	43	3.38E-06	-4.6464
X=Person	7.54717	10.81081	53	3.12E-11	-6.64069

Table S19. Results of the cluster analysis showing dimensions that explain variability in the MCA results (Nova Scotia).

Dimentions		**Eigenvalue percentage of Variance**	**Cumulative percentage of variance**
Dim 1	0.152448	11.61508	11.61508
Dim 2	0.131897	10.0493	21.66438
Dim 3	0.115425	8.794283	30.45866
Dim 4	0.096734	7.370222	37.82888
Dim 5	0.089399	6.811333	44.64022
Dim 6	0.079684	6.071166	50.71138
Dim 7	0.072304	5.508872	56.22025
Dim 8	0.069601	5.302918	61.52317
Dim 9	0.067907	5.173872	66.69704
Dim 10	0.060321	4.595887	71.29293
Dim 11	0.055287	4.212365	75.5053
Dim 12	0.050956	3.882388	79.38768
Dim 13	0.044789	3.412472	82.80016
Dim 14	0.041801	3.184854	85.98501
Dim 15	0.038822	2.9579	88.94291
Dim 16	0.030597	2.331222	91.27413
Dim 17	0.029423	2.241743	93.51587
Dim 18	0.025354	1.931751	95.44763
Dim 19	0.023761	1.810341	97.25797
Dim 20	0.020101	1.531512	98.78948
Dim 21	0.015888	1.21052	100

Table S20. The first 6 dimensions explaining maximum variability in the MCA results (Nova Scotia).

Dimension	**1**	**2**	**3**	**4**	**5**	**6**
Biking	1.059884	1.838381	8.567697	11.39601	0.103939	3.755662
Dog walking	0.012729	2.954087	0.14316	0.642463	8.640683	4.632608
Hiking	0.822613	3.930316	0.07482	0.212655	2.198174	11.50033
No-Act	0.082662	0.086581	0.326985	0.000366	0.856286	0.024224
Picnic	2.956432	0.007685	1.782715	0.959456	13.33212	2.507312
Walking	0.384006	2.017431	2.503438	0.156402	10.77184	1.38648
Yoga	0.015595	0.033029	0.042628	5.409223	3.699507	7.514822
Field	12.68448	0.577778	4.17096	1.03388	0.796371	3.380452
No-Field	2.598027	0.11834	0.854293	0.211759	0.163112	0.692382
Mountain	3.376768	2.735937	9.326521	0.005116	7.372149	0.718305
No-Mountain	1.248942	1.011922	3.449535	0.001892	2.726685	0.265675
No-Water	2.268627	0.851665	0.15229	1.889935	2.32794	0.016613
Water	6.456863	2.423971	0.433442	5.379045	6.625677	0.047284
No-Wine glass	1.297611	0.001717	0.380892	2.054244	1.92401	0.005189

Wine glass	5.531921	0.00732	1.623802	8.757566	8.202358	0.02212
Building	6.744833	1.965608	9.285588	1.643819	0.352443	2.25423
No-Building	1.79293	0.522503	2.468321	0.436965	0.093687	0.599226
No-T-P	0.185355	0.188725	4.153428	3.279793	0.016674	0.665753
T-P	0.657168	0.669117	14.72579	11.62836	0.059116	2.360399
No-T-C	1.369373	7.819803	1.03419	1.199871	0.717532	0.367268
T-C	2.14184	12.23097	1.617579	1.876721	1.122293	0.574444
No-Wine tasting	1.34133	4.027885	0.044668	3.439612	0.00231	0.101767
Wine tasting	3.283945	9.861373	0.109358	8.42112	0.005655	0.249153
AV	0.181121	7.822679	0.08383	3.133861	5.471873	0.063147
No-AV	0.14231	6.146391	0.065867	2.462319	4.299329	0.049616
No-SR	3.903911	0.168902	1.61303	3.749226	0.433055	0.032454
SR	10.55502	0.456662	4.361156	10.1368	1.170853	0.087746
Grassland	0.560988	0.00597	0.00387	0.775633	0.959695	25.15712
No-Grassland	0.373992	0.00398	0.00258	0.517088	0.639797	16.77141
No-Tourism	2.753522	5.274954	1.536085	1.937496	1.709255	2.386954
Tourism	2.645541	5.068093	1.475847	1.861515	1.642225	2.293348
No-Person	6.956049	0.138405	1.009281	0.000751	1.669616	0.297941
Person	9.605972	0.191131	1.393768	0.001037	2.30566	0.411443
No-Tree	2.071542	8.944015	0.881457	3.381019	2.805671	0.381069
Tree	0.930693	4.018326	0.396017	1.519009	1.260519	0.171205
Marketers	0.502703	2.939172	9.952555	0.243991	1.760948	4.127421
Visitors	0.502703	2.939172	9.952555	0.243991	1.760948	4.127421

Table S21. Shows the across-cluster (Cla.Mod) and within-cluster (Mod.Cla) distributions of variables in Cluster 1 resulted from cluster analysis of Nova Scotia.

Variables	**Cla/Mod**	**Mod/Cla**	**Global**	**p.value**	**v.test**
T=No-Tourism	71.42857	83.33333	49	3.12E-09	5.925313
SR=No-SR	57.53425	100	73	1.37E-08	5.677197
WT=No-Wine tating	57.74648	97.61905	71	1.03E-07	5.320988
X=No-Person	63.7931	88.09524	58	1.16E-07	5.299604
TC=No-T-C	57.37705	83.33333	61	8.93E-05	3.918063
F=Field	76.47059	30.95238	17	2.17E-03	3.065835
K=Mountain	62.96296	40.47619	27	1.19E-02	2.513939
S=No-Wine glass	46.91358	90.47619	81	4.19E-02	2.034448
S=Wine glass	21.05263	9.52381	19	4.19E-02	-2.03445
K=No-Mountain	34.24658	59.52381	73	1.19E-02	-2.51394
F=No-Field	34.93976	69.04762	83	2.17E-03	-3.06584

TC=T-C	17.94872	16.66667	39	8.93E-05	-3.91806
X=Person	11.90476	11.90476	42	1.16E-07	-5.2996
WT=Wine tasting	3.448276	2.380952	29	1.03E-07	-5.32099
SR=SR	0	0	27	1.37E-08	-5.6772
T=Tourism	13.72549	16.66667	51	3.12E-09	-5.92531

Table S22. Shows the across-cluster (Cla.Mod) and within-cluster (Mod.Cla) distributions of variables in Cluster 2 resulted from cluster analysis of Nova Scotia.

Variables	Cla/Mod	Mod/Cla	Global	p.value	v.test
WT=Wine tasting	68.96552	74.07407	29	7.61E-09	5.77689
MV=Marketers	48	88.88889	50	1.41E-06	4.823515
TC=T-C	53.84615	77.77778	39	2.14E-06	4.739355
T=Tourism	45.09804	85.18519	51	2.65E-05	4.201836
AV=AV	47.72727	77.77778	44	4.33E-05	4.089182
AV=No-AV	10.71429	22.22222	56	4.33E-05	-4.08918
T=No-Tourism	8.163265	14.81481	49	2.65E-05	-4.20184
TC=No-T-C	9.836066	22.22222	61	2.14E-06	-4.73936
MV=Visitors	6	11.11111	50	1.41E-06	-4.82352
WT=No-Wine tasting	9.859155	25.92593	71	7.61E-09	-5.77689

Table S23. Shows the across-cluster (Cla.Mod) and within-cluster (Mod.Cla) distributions of variables in Cluster 3 resulted from cluster analysis of Nova Scotia.

Variables	Cla/Mod	Mod/Cla	Global	p.value	v.test
SR=SR	70.37037	61.29032	27	7.16E-07	4.956838
X=Person	57.14286	77.41936	42	1.94E-06	4.759724
K=No-Mountain	42.46575	100	73	5.83E-06	4.532329
AV=No-AV	46.42857	83.87097	56	1.42E-04	3.804076
O=No-Water	40.54054	96.77419	74	2.04E-04	3.714033
S=Wine glass	68.42105	41.93548	19	2.36E-04	3.676948
F=No-Field	37.3494	100	83	8.97E-04	3.321007
MV=Visitors	44	70.96774	50	5.54E-03	2.774012
B=No-Building	36.70886	93.54839	79	1.43E-02	2.449416
T=Tourism	41.17647	67.74194	51	2.72E-02	2.208032
N=No-Tree	45.16129	45.16129	31	4.78E-02	1.978751
N=Tree	24.63768	54.83871	69	4.78E-02	-1.97875
T=No-Tourism	20.40816	32.25807	49	2.72E-02	-2.20803
B=Building	9.52381	6.451613	21	1.43E-02	-2.44942

MV=Marketers	18	29.03226	50	5.54E-03	-2.77401
F=Field	0	0	17	8.97E-04	-3.32101
S=No-Wine glass	22.22222	58.06452	81	2.36E-04	-3.67695
O=Water	3.846154	3.225806	26	2.04E-04	-3.71403
AV=AV	11.36364	16.12903	44	1.42E-04	-3.80408
K=Mountain	0	0	27	5.83E-06	-4.53233
X=No-Person	12.06897	22.58065	58	1.94E-06	-4.75972
SR=No-SR	16.43836	38.70968	73	7.16E-07	-4.95684

Table S24. Results of the cluster analysis showing dimensions that explain variability in the MCA results (Ontario).

Dimensions		**Eigenvalue percentage of Variance**	**Cumulative percentage of variance**
Dim 1	0.138239	11.64122	11.64122
Dim 2	0.125461	10.56512	22.20634
Dim 3	0.101094	8.513147	30.71949
Dim 4	0.08361	7.040815	37.7603
Dim 5	0.07982	6.721691	44.48199
Dim 6	0.076323	6.427171	50.90916
Dim 7	0.068504	5.768732	56.6779
Dim 8	0.066936	5.636755	62.31465
Dim 9	0.062952	5.301235	67.61589
Dim 10	0.061092	5.14456	72.76045
Dim 11	0.053496	4.504885	77.26533
Dim 12	0.045182	3.804802	81.07013
Dim 13	0.043149	3.633589	84.70372
Dim 14	0.040902	3.444374	88.1481
Dim 15	0.036211	3.049382	91.19748
Dim 16	0.033444	2.816339	94.01382
Dim 17	0.027591	2.323486	96.3373
Dim 18	0.022888	1.92739	98.26469
Dim 19	0.020607	1.735307	100

Table S25. The first 8 dimensions explaining maximum variability in the MCA results (Ontario).

Dimension	**1**	**2**	**3**	**4**	**5**	**6**
Biking	6.59E+00	2.06926	1.742995	0.344078	0.173635	1.49E+01
Horse riding	3.61E-02	0.103158	1.177123	36.28099	4.355076	4.03E-01
No-Act	1.01E+00	0.560834	0.086503	0.276713	1.575386	4.18E-01
Walking	2.35E+00	1.592804	7.505491	0.027724	0.075741	1.37E+01
Yoga	4.47E-01	0.844063	14.75325	1.036771	15.75988	5.82E+00

Field	1.76E+00	19.22668	0.108677	2.448133	0.363832	5.73E-01
No-Field	1.12E-01	1.227235	0.006937	0.156264	0.023223	3.66E-02
Mountain	6.28E-03	6.478589	0.426143	7.240815	26.26943	5.66E+00
No-Mountain	1.94E-04	0.200369	0.01318	0.223943	0.812457	1.75E-01
No-Water	2.56E-01	0.322118	0.274159	0.779526	0.05936	3.84E-03
Water	4.86E+00	6.120233	5.209026	14.81099	1.127849	7.30E-02
No-Wine glass	1.35E-04	0.422316	1.571252	0.139274	1.169982	1.38E+00
Wine glass	6.58E-04	2.061896	7.671406	0.679987	5.712264	6.74E+00
Building	4.01E+00	2.905303	12.11163	0.402137	0.170644	5.07E-02
No-Building	1.00E+00	0.726326	3.027909	0.100534	0.042661	1.27E-02
No-T-P	2.29E+00	0.164244	0.814053	0.005344	0.0849	2.54E-01
T-P	8.12E+00	0.582318	2.886188	0.018946	0.301011	9.01E-01
No-T-C	3.54E-01	0.417931	0.274184	0.293754	2.616249	2.44E+00
T-C	1.86E+00	2.194138	1.439465	1.542211	13.73531	1.28E+01
No-Wine tasting	1.55E+00	0.192834	0.210034	0.009688	2.923746	1.84E-02
Wine tasting	3.29E+00	0.409772	0.446322	0.020587	6.21296	3.91E-02
AV	1.38E+00	14.92176	4.913299	8.872689	0.977804	6.14E-04
No-AV	3.91E-01	4.208701	1.385802	2.502553	0.275791	1.73E-04
No-SR	3.72E+00	0.687581	0.50484	0.103968	0.415514	6.47E-02
SR	1.18E+01	2.177339	1.59866	0.329232	1.315794	2.05E-01
Grassland	4.03E+00	1.89723	3.936643	4.290031	1.859449	8.45E+00
No-Grassland	1.65E+00	0.774925	1.607924	1.752266	0.759493	3.45E+00
No-Tourism	4.84E+00	0.57042	1.438651	0.635129	3.265591	3.74E+00
Tourism	8.61E+00	1.014079	2.557602	1.129118	5.805494	6.65E+00
No-Person	4.11E+00	8.885974	0.040613	1.779925	0.086897	1.17E-03
Person	3.64E+00	7.880014	0.036015	1.578424	0.07706	1.04E-03
No-Tree	4.59E+00	4.285928	4.146973	2.594168	0.906124	6.18E+00
Tree	3.46E+00	3.233244	3.128418	1.957004	0.683567	4.67E+00
Marketers	3.94E+00	0.320196	6.474312	2.818541	0.002913	8.01E-02
Visitors	3.94E+00	0.320196	6.474312	2.818541	0.002913	8.01E-02

Table S26. Shows the across-cluster (Cla.Mod) and within-cluster (Mod.Cla) distributions of variables in Cluster 1 resulted from cluster analysis of Ontario.

Variables	**Cla/Mod**	**Mod/Cla**	**Global**	**p.value**	**v.test**
AV=No-AV	78.20513	96.8254	78	4.46E-09	5.866145
G=No-Grassland	77.46479	87.30159	71	4.92E-06	4.568001
A=No-Act	70.93023	96.8254	86	9.23E-05	3.909958
SR=No-SR	73.68421	88.88889	76	1.44E-04	3.801579
F=No-Field	67.02128	100	94	1.95E-03	3.097708
N=No-Tree	79.06977	53.96825	43	4.07E-03	2.87285
T=No-Tourism	73.4375	74.60318	64	4.97E-03	2.809115

O=No-Water	66.31579	100	95	5.79E-03	2.759456
TP=T-P	81.81818	28.57143	22	3.91E-02	2.06359
K=No-Mountain	64.94845	100	97	4.81E-02	1.976909
K=Mountain	0	0	3	4.81E-02	-1.97691
A=Biking	0	0	3	4.81E-02	-1.97691
TP=No-T-P	57.69231	71.42857	78	3.91E-02	-2.06359
A=Yoga	16.66667	1.587302	6	2.69E-02	-2.21242
O=Water	0	0	5	5.79E-03	-2.75946
T=Tourism	44.44444	25.39683	36	4.97E-03	-2.80912
N=Tree	50.87719	46.03175	57	4.07E-03	-2.87285
F=Field	0	0	6	1.95E-03	-3.09771
SR=SR	29.16667	11.11111	24	1.44E-04	-3.80158
G=Grassland	27.58621	12.69841	29	4.92E-06	-4.568
AV=AV	9.090909	3.174603	22	4.46E-09	-5.86615

Table S27. Shows the across-cluster (Cla.Mod) and within-cluster (Mod.Cla) distributions of variables in Cluster 2 resulted from cluster analysis of Ontario.

Variables	**Cla/Mod**	**Mod/Cla**	**Global**	**p.value**	**v.test**
K=Mountain	100	75	3	2.47E-05	4.217184
AV=AV	18.18182	100	22	1.87E-03	3.110851
A=Horse	100	25	1	4.00E-02	2.053749
AV=No-AV	0	0	78	1.87E-03	-3.11085
K=No-Mountain	1.030928	25	97	2.47E-05	-4.21718

Table S28. Shows the across-cluster (Cla.Mod) and within-cluster (Mod.Cla) distributions of variables in Cluster 3 resulted from cluster analysis of Ontario.

Variables	**Cla/Mod**	**Mod/Cla**	**Global**	**p.value**	**v.test**
AV=AV	72.72727	66.66667	22	2.37E-08	5.582405
G=Grassland	51.72414	62.5	29	9.24E-05	3.909817
O=Water	100	20.83333	5	5.65E-04	3.448095
SR=SR	50	50	24	1.46E-03	3.182138
F=Field	83.33333	20.83333	6	2.94E-03	2.974393
A=Yoga	83.33333	20.83333	6	2.94E-03	2.974393
N=Tree	31.57895	75	57	4.36E-02	2.018146
N=No-Tree	13.95349	25	43	4.36E-02	-2.01815
F=No-Field	20.21277	79.16667	94	2.94E-03	-2.97439
SR=No-SR	15.78947	50	76	1.46E-03	-3.18214
O=No-Water	20	79.16667	95	5.65E-04	-3.4481
G=No-Grassland	12.67606	37.5	71	9.24E-05	-3.90982

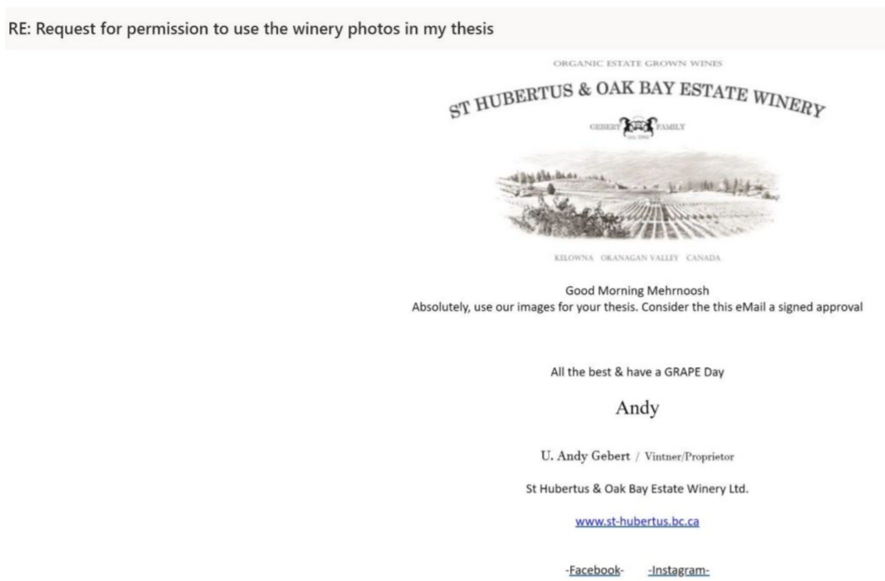
AV=No-AV	10.25641	33.33333	78	2.37E-08	-5.58241

Table S29. Shows the across-cluster (Cla.Mod) and within-cluster (Mod.Cla) distributions of variables in Cluster 4 resulted from cluster analysis of Ontario.

Variables	**Cla/Mod**	**Mod/Cla**	**Global**	**p.value**	**v.test**
A=Biking	100	33.33333	3	0.000519	3.470505
MV=Visitors	18	100	50	0.001317	3.212227
A=Walking	75	33.33333	4	0.002014	3.088211
X=Person	16.98113	100	53	0.00233	3.044627
N=Tree	15.78947	100	57	0.004729	2.824908
WT=Wine	21.875	77.77778	32	0.004812	2.81934
T=Tourism	19.44444	77.77778	36	0.010982	2.543267
B=Building	25	55.55556	20	0.016507	2.397507
SR=SR	20.83333	55.55556	24	0.039713	2.056724
SR=No-SR	5.263158	44.44444	76	0.039713	-2.05672
B=No-Building	5	44.44444	80	0.016507	-2.39751
T=No-Tourism	3.125	22.22222	64	0.010982	-2.54327
WT=No-Wine	2.941176	22.22222	68	0.004812	-2.81934
N=No-Tree	0	0	43	0.004729	-2.82491
X=No-Person	0	0	47	0.00233	-3.04463
MV=Marketers	0	0	50	0.001317	-3.21223
A=No-Act	3.488372	33.33333	86	0.000175	-3.75258

APPENDIX C: INSTAGRAM USERS' PERMISSIONS TO USE THEIR PHOTOS FOR THE PURPOSE OF MY THESIS

In this document, I'm showcasing the permission I received from the photographers for using their photo in my thesis. I received the consent from the owner of the St Hubertus & Oak Bay Winery Instagram page (@sthubertuswine) through email (Figure S3). However, the rest of the consents are obtained through communicating with the photographers via direct message on Instagram (Figure S4).


RE: Request for permission to use the winery photos in my thesis

ORGANIC ESTATE GROWN WINES

ST HUBERTUS & OAK BAY ESTATE WINERY

KELOWNA OKANAGAN VALLEY CANADA

Good Morning Mehrnoosh

Absolutely, use our images for your thesis. Consider the this eMail a signed approval

All the best & have a GRAPE Day

Andy

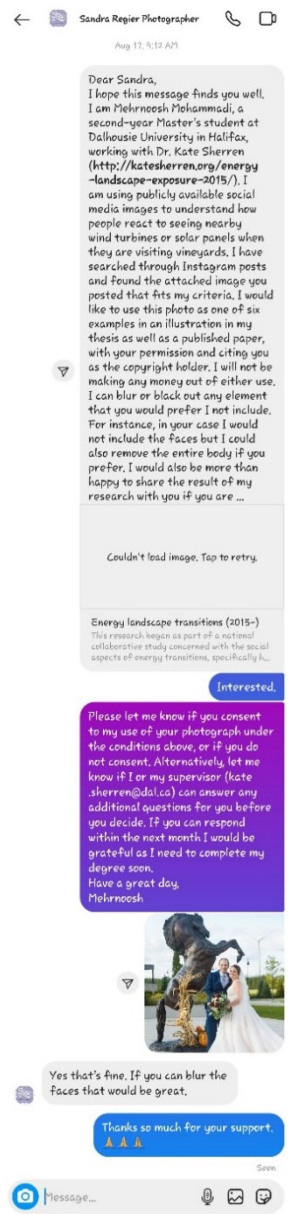
U. Andy Gebert / Vintner/Proprietor

St Hubertus & Oak Bay Estate Winery Ltd.

www.st-hubertus.bc.ca

-Facebook- -Instagram-

Figure S3. Consent from the owner of the St Hubertus & Oak Bay Winery Instagram page (@sthubertuswine)


Sandra Regier Photographer

Aug 17, 9:13 AM

Dear Sandra,
I hope this message finds you well. I am Mehrnoosh Mohammadi, a second-year Master's student at Dalhousie University in Halifax, working with Dr. Kate Sherren (http://katesherren.org/energy-landscape-exposure-2015/). I am using publicly available social media images to understand how people react to seeing nearby wind turbines or solar panels when they are visiting vineyards. I have searched through Instagram posts and found the attached image you posted that fits my criteria. I would like to use this photo as one of six examples in an illustration in my thesis as well as a published paper, with your permission and citing you as the copyright holder. I will not be making any money out of either use. I can blur or black out any element that you would prefer I not include. For instance, in your case I would not include the faces but I could also remove the entire body if you prefer. I would also be more than happy to share the result of my research with you if you are ...

Couldn't load image. Tap to retry.

Energy landscape transitions (2015-)
This research began as part of a national collaborative study concerned with the social aspects of energy transitions, specifically h...

Interested.

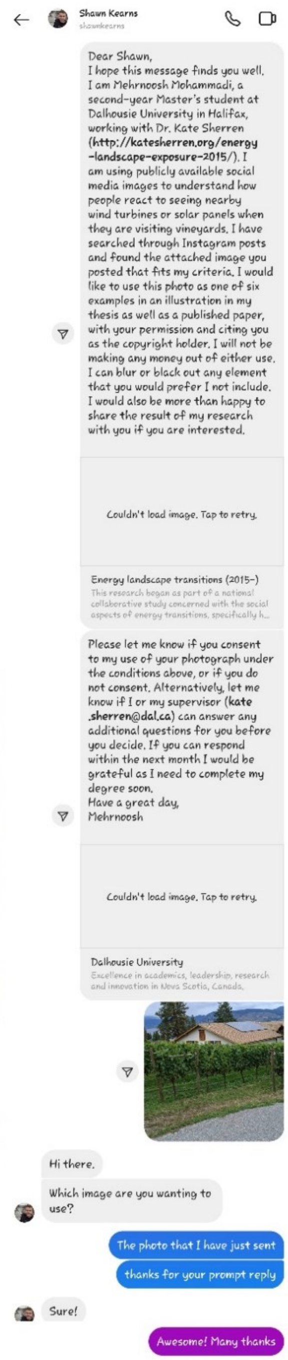
Please let me know if you consent to my use of your photograph under the conditions above, or if you do not consent. Alternatively, let me know if I or my supervisor (kate.sherren@dal.ca) can answer any additional questions for you before you decide. If you can respond within the next month I would be grateful as I need to complete my degree soon.
Have a great day,
Mehrnoosh

Yes that's fine. If you can blur the faces that would be great.

Thanks so much for your support. 🙏🙏🙏

Seen

Message...


Shawn Kearns
shawnkearns

Dear Shawn,
I hope this message finds you well. I am Mehrnoosh Mohammadi, a second-year Master's student at Dalhousie University in Halifax, working with Dr. Kate Sherren (http://katesherren.org/energy-landscape-exposure-2015/). I am using publicly available social media images to understand how people react to seeing nearby wind turbines or solar panels when they are visiting vineyards. I have searched through Instagram posts and found the attached image you posted that fits my criteria. I would like to use this photo as one of six examples in an illustration in my thesis as well as a published paper, with your permission and citing you as the copyright holder. I will not be making any money out of either use. I can blur or black out any element that you would prefer I not include. I would also be more than happy to share the result of my research with you if you are interested.

Couldn't load image. Tap to retry.

Energy landscape transitions (2015-)
This research began as part of a national collaborative study concerned with the social aspects of energy transitions, specifically h...

Please let me know if you consent to my use of your photograph under the conditions above, or if you do not consent. Alternatively, let me know if I or my supervisor (kate.sherren@dal.ca) can answer any additional questions for you before you decide. If you can respond within the next month I would be grateful as I need to complete my degree soon.
Have a great day,
Mehrnoosh

Couldn't load image. Tap to retry.

Dalhousie University
Excellence in academics, leadership, research and innovation in Nova Scotia, Canada.

Hi there.

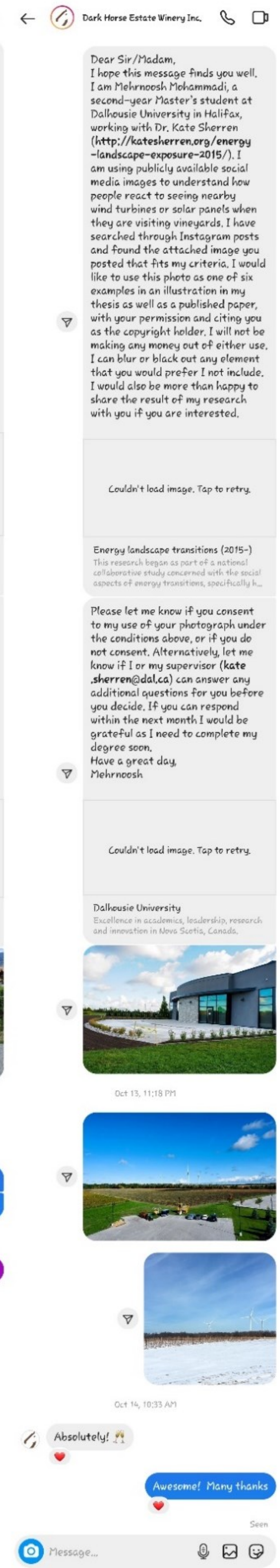
Which image are you wanting to use?

The photo that I have just sent

thanks for your prompt reply

Sure!

Awesome! Many thanks


Dark Horse Estate Winery Inc.

Dear Sir/Madam,
I hope this message finds you well. I am Mehrnoosh Mohammadi, a second-year Master's student at Dalhousie University in Halifax, working with Dr. Kate Sherren (http://katesherren.org/energy-landscape-exposure-2015/). I am using publicly available social media images to understand how people react to seeing nearby wind turbines or solar panels when they are visiting vineyards. I have searched through Instagram posts and found the attached image you posted that fits my criteria. I would like to use this photo as one of six examples in an illustration in my thesis as well as a published paper, with your permission and citing you as the copyright holder. I will not be making any money out of either use. I can blur or black out any element that you would prefer I not include. I would also be more than happy to share the result of my research with you if you are interested.

Couldn't load image. Tap to retry.

Energy landscape transitions (2015-)
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Please let me know if you consent to my use of your photograph under the conditions above, or if you do not consent. Alternatively, let me know if I or my supervisor (kate.sherren@dal.ca) can answer any additional questions for you before you decide. If you can respond within the next month I would be grateful as I need to complete my degree soon.
Have a great day,
Mehrnoosh

Couldn't load image. Tap to retry.

Dalhousie University
Excellence in academics, leadership, research and innovation in Nova Scotia, Canada.

Oct 13, 11:18 PM

Oct 14, 10:33 AM

Absolutely! 🥂

Awesome! Many thanks

Seen

Message...

Figure S4. A composite photo displaying direct messages with three different users, including @darkhorseestatewinery, @sandraregierphotographer, and @shawnkearns